PUMP UP YOUR PACKS
4-IN-1 Li-POLY CHARGER

OVER THE EDGE
SLOPE WARBIRDS

free online plan!
Micro Eindecker p.134

MODEL Airplane NEWS

CATCH IT!

FUN FLY FEVER

Your guide to ultimate performance p.84

Great Planes
PT-17 Stearman

TAKE CONTROL!

10 TOP RADIO SETUPS

WORLD'S BIGGEST single
Saito FA-220a

November 2005
MODELAIRPLANENEWS.COM

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ON THE COVER: the Stearman PT-17 from Great Planes is reviewed by Gerry Yarrish on page 40. (Photo by Pete Hall.)

ON THIS PAGE: Thunder Tiger's Christen Eagle is reviewed on page 60. (Photo by John Reid.)

[PreFlight]

BY DEBRA CLEGHORN

Competition Fun-fly

They may start out as friendly competitions, but fun-fly events often evolve into out-and-out flying wars, pitting pilot against pilot to see who really has the best thumbs. Get the edge on the competition by reading "Fun Fly!"—our special feature with insider secrets about everything you'll need to know, from what makes a good fun-fly model to the best gear to use to how to maximize your score. For a guaranteed adrenaline rush, take up the fun-fly challenge.

Everyone knows that the only way to become a pro pilot is to practice, practice, practice, but using a computer radio can make your plane look better in a hurry! In "Maximum Control," we share 10 top computer-radio setups that can immediately improve your airplane's performance. Once you start to use these easy setups, you'll wonder how you ever flew without them!

Every year, soaring enthusiasts trek to Cajon Summit in California's San Bernardino National Forest for the Southern California Power Scale Soaring Festival—one of the best sites of its kind in the country. Photojournalist Dave Garwood was on hand to capture the action; check out this exciting (and growing!) sport as well as some very impressive scale planes on page 32.

Our construction article this month is another winner from designer Jim Ryan's hangar. Powered by a Speed 400 motor, the A6M2 Zero is 1/14 scale and has a fully sheeted foam wing; its fuselage is built around a removable crutch. Jim notes that although the Zero flies a bit faster than most Speed 400-class warbirds, it's easy to land.

If you like your warbirds even smaller, Dave Robelen's Micro Fokker Eindecker is right up your alley. Featured in our "Micro RC" column, this 16.4-inch-span, 3-channel fighter uses traditional all-balsa construction and is controlled by magnetic actuators. The Eindecker is a gentle flyer that's well-suited to both indoor and outdoor flying. Download the free online plan at modelairplanenews.com, and add one to your air force!

A formidable piece of machinery, Saito's latest 4-stroke made quite an impression on engine reviewer Dave Gierke. Not only is the FA-220a capable of turning 22- and 24-inch props with ease, but it's also the largest single-cylinder engine the hobby industry has seen! Check out Dave's detailed findings on page 56.

Electrics enthusiast who are hooked on the long flight times and extra performance offered by Li-poly batteries won't want to miss Bob Aberle's review of the ElectriFly PolyCharge 4. This new unit is actually four chargers in one, so you'll have plenty of charged packs on hand, and you'll be able to fly for as long as you like.

Safe landings.

Debra Cleghorn

Executive Editor

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[AirWaves]

BASIC TRAINER MUSTANG

I was very pleased to see a review of the new Hangar 9 Mustang PTS in your September issue. I think you guys are the first to publish any data on this new "trainer" sport model. I had heard rumors about a new trainer, but it didn't seem possible that anyone could learn to fly on a P-51 Mustang. So tell me: could I learn all by myself?

ROBERT CONRAN, MIDDLEBURY, IN

Robert, yes; it is true that you can learn to fly using the new Mustang PTS from Hangar 9. The progressive training system works very well, and with the added DVD, flight simulator and buddy-box cable, your success is all but guaranteed. I don't recommend that you wing it on your own, though; you should always use an instructor pilot to help you navigate the learning curve. Join a local RC club, and before you know it, you'll have earned your wings! Go for it! ***—GY***

HURRAY FOR THE HOTS

I was pleasantly surprised to see the full-size pull-out plan for the Hots in the September issue. This is what I used to see in model airplane magazines when I was much younger (I just tried to download the construction article, and it came right through). I hope these plans are a renewed trend that receives a positive response. Keeping the plans and airplanes simple and not too involved should keep your readers coming back for more! My first free-flight gas model in 1942 was a "Playboy Senior" with a Herkimer OK .49 gas engine. The kit cost $4.95 and was covered with silkspan and doped! I sold the whole works later for $42. Maybe a small version of this model, modified for rudder, elevator and throttle, would be something to look into! Thanks again for the Hots plan.

BOB SOERGEL [EMAIL]

Glad you approve, Bob. We've had lots of positive feedback on the Hots, and we're happy to tell you that the pullout plans are here to stay! ***—DC***

MUCKED-UP MUFFLERS

Have you ever published an article about cleaning the hard, baked-on residue on the exterior surface of mufflers? I've tried several household and automotive cleaning products on mine but have not had very satisfactory results.

ED INGOLD, JACKSON, WY

Ed, we have not run an article specifically about muffler cleaning, but we published Dave Gierke's article "Engine Maintenance—how to take care of your model's powerplant" in the August 2005 issue. In it, Dave recommends a brand called "Demon Clean" to remove baked-on castor-oil varnish. This thick engine cleaner is brushed on, allowed to work and then hosed off with water. Distributed by Cooper's Custom Blended Fuels, it does an excellent job. Contact Cooper's at (269) 420-1539; cooperfuels.com. — *GY*

STICKY QUESTION

Could you please tell me which type of glue is used to hold your complimentary plans in your magazines? I am looking for something similar to apply to the back of stencils for spray painting on my models. Your product holds but comes off easily and is flexible; I think it would be ideal to stop paint from creeping under the pattern edges.

RUSSELL THOMAS, MELBOURNE, AUSTRALIA

Russell, the glue used in the production and binding of Model Airplane News *is an industrial adhesive that's available only in the printing industry—not in the small quantities suitable for modelers. It is basically a quick-drying rubber cement that is applied to the plan as it is inserted into each magazine as it exits the printing press. For holding and sealing the edges of paint stencils, you might want to try using ordinary rubber cement thinned slightly with a solvent (MEK or acetone). There is also an adhesive available at home-improvement stores under the "Post-It" brand name that might also be acceptable. Of course, you should first test anything you intend to apply to your model. To minimize seepage under the stencil, try spraying a light coat of paint over the stencil to seal the edges. Use the same color as the underlying paint, let it set for a few moments, and then apply the trim color in light mist coats. Good luck.* — *GY*

WONDERFUL WARHAWK

I was very interested in John Reid's article on the Hangar 9 P-40 Warhawk. I, too, have built the Hangar 9 P-40. Mine flies with a Magnum .91 4-stroke, which pulls it with commanding power, and a JR 6-channel radio. I agree with John that the model builds easily, and all of its parts fit very well. Little sanding, rubbing, or modifying is necessary. I had to add ¼-inch bushings to the engine mounts to move the engine farther forward, though, and this brought the CG close, so I added another 10 ounces of nose weight to get the correct CG. The model has very scale takeoff and landing characteristics and can perform any maneuver that the full scale P-40 does. Hangar 9 has done a great job on this model, and with a little time to detail it, the aircraft will provide hours of enjoyment at the field.

LOUIE NAVAR [EMAIL]

Louie, thanks for writing. Hangar 9 has produced some really good flying models, and the Warhawk continues that tradition. Getting into scale models successfully has never been easier! —*JR*

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

[Tips&Tricks]

ILLUSTRATIONS BY RICHARD THOMPSON

Pack history

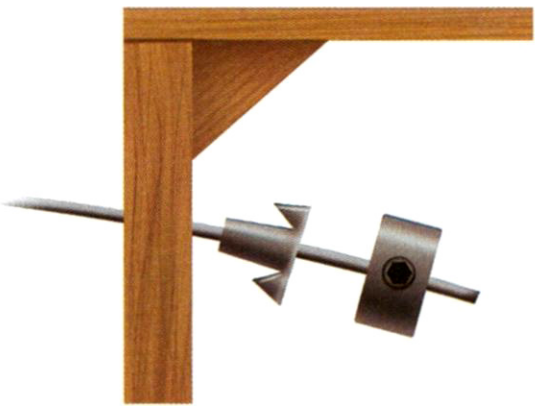
Here's a way to document the history of your battery packs. Tape a label to each pack, and on it, record charges, discharges and capacity/date, etc. If you cover the labels with wide, clear-plastic tape, you'll be able to use a wipe-off wax pencil.

George Leo, Flemington, NJ

Tube-holding jig

Holding a thin tube while you file or drill it can be tricky. Slip the tube into a regular spring-type clothespin, and then hold the clothespin in a vise. You can file slots of several sizes in the clothespin to accept tubes of more than one size.

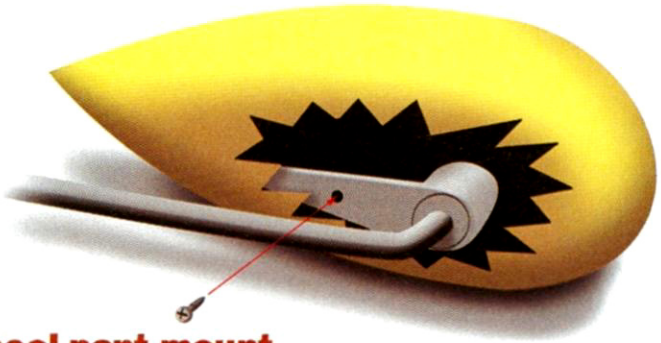
John Higgins, Atlantic City, NJ



Blind-nut fitting

Do you ever inadvertently install a firewall without first installing the blind nuts? If you do, there's a solution. Feed music wir through the firewall from the front until it exits the wing saddle; then slip the blind nut onto the wire and follow it with a wheel collar, which you tighten securely. Using pliers, pull the nut into place on the wire, and securely embed the prongs by tightening a screw (and a washer) from th front of the firewall.

Jerry Dickerson, Los Angeles, CA



Wheel-pant mount

To hold a wheel pant firmly in place yet still allow some flexibility, clamp a nose-gear steering arm to the part of the axle that's inside with the setscrew, and screw a couple of sheet-metal or wood screws through the pant and into the steering arm.

Tom Severance, Kittery, ME

SEND IN YOUR IDEAS! *Model Airplane News* will give a free, one-year subscription (or a one-year renewal, if you already subscribe) for each idea used in "Tips & Tricks." Send a rough sketch and a brief description to Model Airplane News, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE THAT YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SUBMISSION. Because of the number of ideas we receive, we can neither acknowledge each one nor return unused material.

[PilotProjects]

1 Stuka Ju87B Dive Bomber

Aisham Bo-Jawdeh
Bromana, Beirut, Lebanon

Besides the engine cowl and the large one-piece canopy, Aisham's Stuka was entirely scratch-built using Nick Ziroli plans. He powers his model with a Zenoah G-62 engine. This 18.5-percent scale Stuka features all hand-cut parts and functional landing lights. The finish is a combination of polyurethane sealer and lacquer that has been sanded and primed, then spray-painted and fuelproofed. He chose a color scheme from an StG-2 that flew in Tmimi, Libya, in 1941.

2 Tiger Moth "URF"

Richard Baylis
Westmount, Quebec, Canada

Richard modified his Kyosho Tiger Moth to look like one he had seen in the UK. Although the Tiger Moth is considered an ARF, Richard refers to his plane as a "URF" (ultimately ready-to-fly). He painted the struts yellow, added more detail to the cockpit and undercarriage, added anti-spin strakes, changed the model's surface markings and added a scale corrugated surface to the top wing's center section fuel tank using Plastruct strips. Richard powers his 6½-pound Tiger Moth with a Saito .56 4-stroke engine.

3 Telemaster 40

John DeLong, Plant City, FL

John's Telemaster performed so well with its stock wheel-landing-gear setup that he decided to convert it to a floatplane. Using 36-inch floats and adding a sixth servo for water rudders, John tells us, "It is a terrific flyer!" He currently controls his Telemaster with a Futaba radio system and uses a SuperTigre .45 engine for power, but he plans to soup up its flight performance by installing an O.S. .61 engine, which will give the model extra power for water takeoffs.

SEND IN YOUR SNAPSHOTS!

Model Airplane News **is your magazine, and we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Color slides and color prints are acceptable, but please do not send digital printouts or Polaroid prints. Emailed submissions must be at least 300dpi. We receive so many photographs that we are unable to return them. Each month, one pilot's project will be selected as the "Project of the Month" and will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from among the published "Project of the Month" selections. Send entries to "Pilot Projects,"** ***Model Airplane News,*** **100 East Ridge, Ridgefield, CT 06877-4606 USA.**

>>PROJECT OF THE MONTH

4 Top Flite P-47 Thunderbolt

Steve Hardin, North Webster, IN

Built to replicate the "Miss Mary Lou," flown by Maj. Henry McAfee of the 318th Fighter Group on Saipan, this P-47 demands its spectators' attention. With a 63-inch wingspan, Steve's model also features a fiberglass finish on the fuselage. It is powered by a SuperTigre .75 2-stroke engine and features Tower Hobbies radio gear, dual receiver batteries, dual servos for both ailerons and flaps and Robart retracts. The finish is Krylon Olive Drab, Dove Gray and Rustoleum Aluminum. Steve used the chart tape and primer method to make the P-47's panel lines, and the nose art is homemade as well.

5 Mini Max Ultralight

Wesley Perkins, Georgetown, TX

Designed and scratch-built to replicate his father's Mini Max, 14-year-old modeler Wesley used Floyd Manly's 1/4-scale plans that were previously published in *Model Airplane News*. With a 74-inch wingspan and 45½-inch length, Wesley's Mini Max weighs only 6½ pounds. He powers his model with a Saito .40 4-stroke engine, and it's covered with UltraCote. Wesley says, "It flies like the real aircraft! I love flying it because it looks so much like my dad's Mini Max in the air and on the ground."

6 Sig Spacewalker

Charles Barsony
Brantford, Ontario, Canada

Using a powerful ZDZ-40RV engine, a Futaba Super Seven transmitter and a 20x10 prop, this 1/3-scale Spacewalker took Charles about 450 hours to build! A modeler for nearly 60 years, Charles worked on his Spacewalker project for more than three years! A modification to his kit included reorganizing the firewall. Since the engine has its carburetor on its back, the carb needed to be passed through the firewall. To get air to the carb, the fuel cap seen in front of the windshield was converted to a ram air source. Charles' model is covered with 10 coats of Randolph Aircraft Products dope.

7 The World Models Zero

Greg Minden, Las Vegas, NV

This giant-scale, WW II Japanese Zero is a "real pleasure to fly, with no bad habits at all," according to Greg. He powers his model with a Moki 1.80 engine turning an 18x10 Master Airscrew prop, and he uses a JR 9303 radio and servos for control. Greg has also made some modifications to his Zero, such as replacing the stock retracts with Spring-Air pneumatic retracts equipped with Robart struts to ensure solid landings. He created an instrument panel, a gun sight, machine guns and panel lines to give his Zero a more scale look. He also repainted the provided pilot figure to look more like a WW II Japanese pilot.

AirScoop

WHAT'S HOT AND WHERE TO GET IT

THE WORLD MODELS

KATANA S

Available in 29-percent and 36-percent scales, these KatanaS aerobats feature top-quality balsa and hardwood construction, iron-on covering, painted fiberglass cowls and balsa-sheeted, foam-core wings with symmetrical airfoils. Detachable stabilizers and two-piece wings make transportation easy. All the necessary hardware is included. The 29-percent KatanaS requires a 50 to 60cc engine and a 4-channel radio with 8 servos; the 36-percent version requires a 100cc engine and a 6-channel radio with 9 servos. Specs (29/36 percent): wingspan, 84/106 in.; wing area, 1,131/2,100 sq. in.; weight, 16 to 18/26 to 28 lb.; length, 75.5/93 in.

THE WORLD MODELS; *distributed by Airborne Models (925) 371-0922; theworldmodels.com.*

JR SPORT

Here's something that sport fliers will appreciate: high-quality radio equipment at a budget-friendly price. JR Sport offers many of the best analog servos, radios, receivers and accessories at prices that everyone can afford. Whether it's a servo extension, a high-torque servo, or a 10-memory, 6-channel radio with exponential, JR Sport has you covered. Products include FM radio systems with up to 6 channels, analog servos, Silver Series extensions, receivers that are compatible with other major brands and JR's most popular AirPacs. Visit Horizon's website or a hobby dealer for more details.

JR; *distributed by Horizon Hobby Inc. (800) 338-4639; horizonhobby.com.*

GREAT PLANES MODEL MFG.

CURTISS HAWK P-6E

Relive the Golden Age of military aviation with this glorious ARF. Debuted and flown at the 2005 AMA Scale Nats, the 76-inch-span Curtiss Hawk P-6E requires a .60 to .90 2-stroke or a .91 to 1.20 4-stroke. With the high-quality construction and attention to detail that Great Planes airplanes are known for, this pursuit model features built-up wood construction, MonoKote covering and a painted fiberglass cowl and wheel pants. Decals, hardware and an instruction manual are also included.

GREAT PLANES MODEL MFG. *(217) 398-6300; (800) 682-8948; greatplanes.com.*

FMA DIRECT

SKYVOLT Li-POLY SYSTEM

If you're into large electrics, this Li-poly system will rock your world! Skyvolt Li-poly packs feature individually wired cells so that each can be charged independently, and the Skyvolt 6s's multi-output charger is designed to work with them. Add Skyvolt's Digital Protection Module between your battery and speed control, and you'll have the ultimate in Li-poly safety and reliability; a Charge Protection Module allows you to charge Skyvolt's special packs with any standard Li-poly charger. Look for an in-depth review coming soon!

FMA DIRECT *(800) 343-2934; (301) 668-7614; fmadirect.com.*

GIANTSCALEPLANES.COM

TIGER MOTH 370

It may be small, but this Tiger Moth won't be grounded by a breeze. This ARF features high-quality construction and covering and all the necessary hardware. A 370 outrunner motor, 3 microservos and a 10A speed control are recommended. Specs: wingspan, 26.4 in.; length, 19.7 in.; weight, 0.5 to 0.6 lb. Look for a J-3 Piper Cub, a Fokker Dr.1, a Sopwith Camel, a de Havilland DH.1 and an SE5a to join the Tiger Moth soon. Price? $130.

GIANTSCALEPLANES.COM *(610) 282-4811.*

FLYZONE BY HOBBICO

RC PREDATOR

This mini Predator scores high on our cool-factor scale! If you're like us, you've dreamed of having a UAV to call your own. This one sports a 38¾-inch wingspan, is 21½ inches long and comes with an installed geared 130 motor, a NiMH battery, a spare propeller and an instructional DVD. The RTF version also comes with a 3-channel radio, an ESC (with auto cutoff) and a 12V DC quick field charger. The ARF Predator needs a 3-channel radio with V-tail mixing, 2 microservos, a micro-receiver and an ESC. The ARF Predator costs $100; the RTF version costs $200.

FLYZONE BY HOBBICO (217) 398-6300; (800) 682-8948; hobbico.com.

BALSA USA

GIANT-SCALE FOKKER D-7

This ⅓-scale kit has all the same exceptional flying qualities as its ¼-scale brother and commands respect wherever it goes! The kit features seven sheets of rolled, full-size plans, illustrated instructions, prebent wire struts with scale fairings, shaped hardwood N-struts, a functional bungee-cord suspension, a sprung tailskid, aluminum side panels, name-brand hardware and plug-in wings with aluminum joiner tubes. Best of all, it doesn't have rigging wires! Specs: wingspan, 118 in.; length, 91 in.; weight, 40 to 45 lb.; wing area, 3,818 sq. in.; engine req'd, 50 to 80cc. The Fokker D-7 costs $560.

BALSA USA *(906) 863-6421; balsausa.com.*

GREAT PLANES

SEAWIND

The classic homebuilt Seawind amphibian is now a sleek and stylish ARF that's designed for easy water takeoffs and great flight characteristics. Substitute optional retracts for the included fixed landing gear, and you'll be able to fly off land and water! With gelcoated wingtips and a fiberglass fuselage, built-up wings covered in MonoKote and a plug-in wing, the Seawind can be flight-ready in about 15 hours. A 3-blade aluminum spinner and a foam stand are included. Specs: wingspan, 71 in.; wing area, 676 sq. in.; weight, 10¼ to 12¼ lb; power req'd, .60 2-stroke or .70 to .91 4-stroke; radio req'd, 5- to 7-channel with 7 to 9 servos. The Seawind costs $360.

GREAT PLANES *(217) 398-6300, (800) 682-8948; greatplanes.com.*

READYTOFLYFUN.COM

THUNDERBAT XF

A barnburner of the first degree, the Thunderbat XF has a molded-foam delta wing and comes with two plastic nose sections. It arrives with an installed Speed 380 motor, two elevon servos and two pusher propellers. A 15A ESC with a 4.8V BEC and motor shutoff, two 900mAh, 8.4V NiMH packs and a 12V charger are also part of the package. It costs $140 ($120 without the charger).

READYTOFLYFUN.COM *(866) 472-8697.*

VENOM AIR CORPS

PARK FIGHTERS

These new fighters are ready for combat. The P-51D Mustang and the A6M Zero come assembled, painted and with brushless motors, Li-poly-compatible speed controls and microservos installed. You need only attach your 4-channel receiver and a 2- or 3-cell Li-poly pack, and you're ready for action. Each Park Fighter costs around $200.

VENOM AIR CORPS *(208) 762-0620; venom-aircorps.com.*

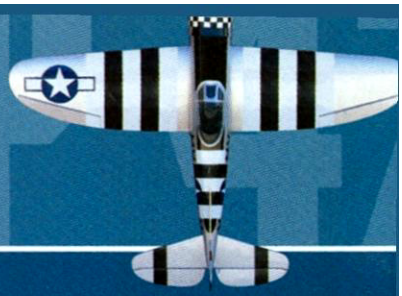
ATLANTAHOBBY.COM

KATANA MINI

This exciting aircraft will fly any maneuver you want, and it's also gentle enough for relaxing, neighborhood flying. It features a two-piece removable wing, laser-cut parts, a painted fiberglass cowl and wheel pants, a tinted canopy and carbon-fiber landing gear. The extensive use of carbon-fiber parts and reinforcements results in an extremely light, strong airframe. The Katana Mini costs $120 and is available in four color schemes.

ATLANTAHOBBY.COM *(678) 513-4450.*

P-47 THUNDERBOLT 60



NO GUTS... NO GLORY

Tough, rough and tenacious. That's the P-47 Thunderbolt, a heavyweight World War II fighter so intimidating it was called "The Unbreakable." Now you can scream into combat, strafe the enemy, and bank into a victory roll from the comfortable environs of your local flying field.

Hangar 9's P-47 Thunderbolt 60 ARF features a factory-painted checkerboard cowl, bubble canopy and nostalgic "No Guts–No Glory!" UltraCote® trim scheme that will have you believing you're protecting the English Channel in 1942

HAN2975

Wingspan:	65 in
Length:	51.2 in
Wing Area:	727.5 sq in
Weight:	7.5–8.5 lb
Radio:	5 channels w/6 servos
Engine:	.60–1.00 2-stroke
	.72–1.00 4-stroke

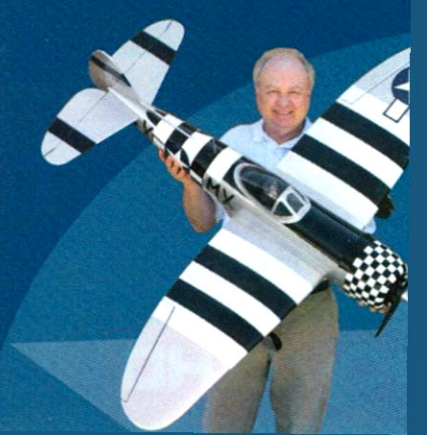
It performs like a classic sport model, enjoying smooth rolls, loops and inverted flight, while the preinstalled retractable landing gear will have you touching down with confidence.

For an unbelievable combination of accurate scale looks and astonishing flight performance, the lightweight balsa-and-ply P-47 Thunderbolt 60 ARF from Hangar 9® is your warbird of choice

HANGAR 9®

Hangar 9's rugged and durable factory-installed landing gear is guaranteed to provide solid landings.

The prepainted checkerboard cowl, bubble canopy and "No Guts–No Glory!" scheme add immeasurably to the nostalgic scale appearance.



SWING

High-performance hand-launch gliders are now available to everyone with the new Kyosho Swing. It has top-quality balsa rib construction and a lightweight FRP fuselage for the ultimate balance of performance and quality.

FRP HAND LAUNCH GLIDER

Swing (ARF)

No.10312B

Specifications:
Length: 32.5 in. (825mm)
Wingspan: 48.8 in. (1240mm)
Weight: Approx. 6.9 oz. (195g)
Includes decals & Linkage hardware

Requires:
Radio: 4-channel
Receiver battery: 4.8V, 110 mAh NiCd or NiMH
Battery charger

MUSTANG

The immortal P51D is captured in exacting detail in the new Kyosho Backyard Series. It features very fine details for a plane of its class and has scale landing gear that's quickly and easily installed and removed for takeoff and landing on a variety of surfaces. It's a scale model that you can fly!

BACKYARD FLYER SERIES

BACKYARD FLYERS SERIES

P51D MUSTANG M24

(ARF No.10231B / RTF No.10232-352B)

Specifications:
Length: 25.9 in. (658mm)
Wingspan: 31.4 in. (798mm)
Wing area: 170.5 sq. in. (11 dm2)
Weight (RTF): 15.9 oz. (450g)
Motor: geared 280-class

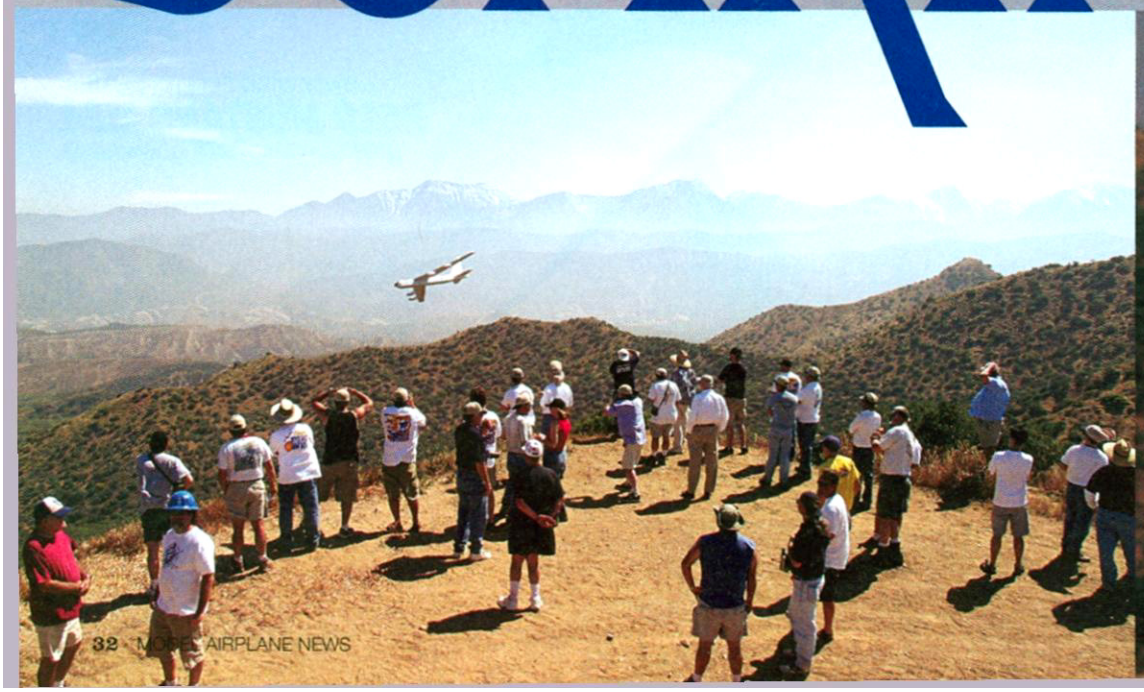
RTF includes:
4 Channel, 2-servo radio
Receiver/Speed Control Combo
600 mAH Ni-MH Battery
12 Volt Quick Charger
Decals

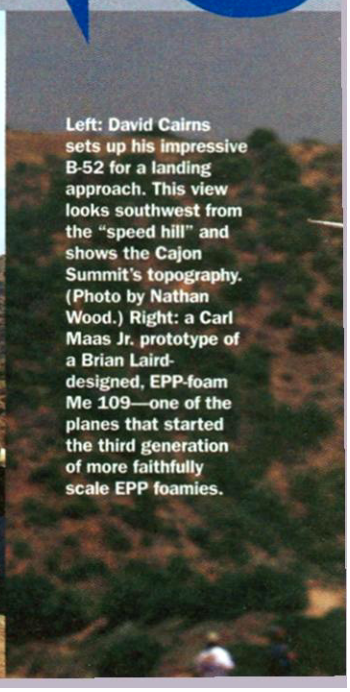
ARF requires:
Electronic speed control
Micro servos (2)
Micro receiver
4-channel Airplane Radio Transmitter
8.4V-600mAh Ni-MH Battery
Battery Charger

www.kyosho.com

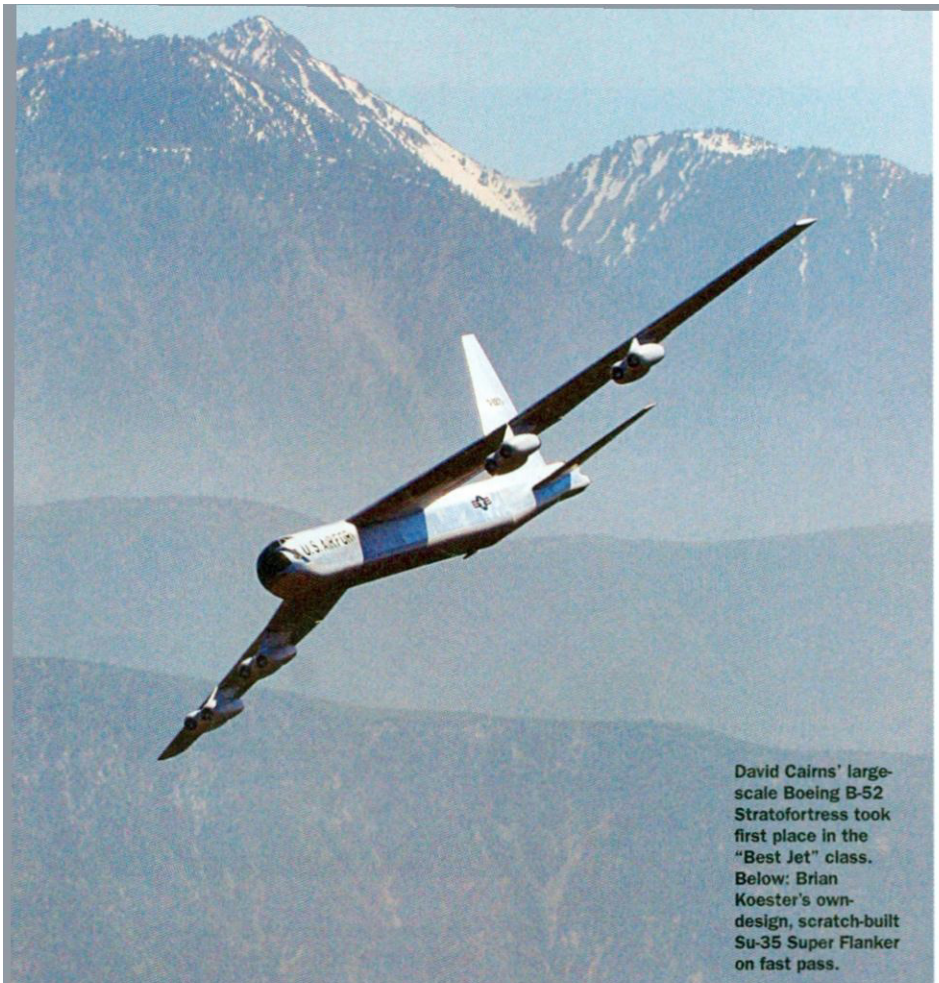
Brian Laird's original-design, molded-fiberglass Messerschmitt Me 262 is shown against the snow-covered San Gabriel Mountains, which are visible from the PSS flying sites. (Photo by Nathan Wood.)

PURE SOARING





Left: David Cairns sets up his impressive B-52 for a landing approach. This view looks southwest from the "speed hill" and shows the Cajon Summit's topography. (Photo by Nathan Wood.) Right: a Carl Maas Jr. prototype of a Brian Laird-designed, EPP-foam Me 109—one of the planes that started the third generation of more faithfully scale EPP foamies.



David Cairns' large-scale Boeing B-52 Stratofortress took first place in the "Best Jet" class. Below: Brian Koester's own-design, scratch-built Su-35 Super Flanker on fast pass.

PLEASURE

Southern California PSS Festival 2005

In Power Scale Soaring (PSS), we build models of aircraft that are powered by piston engines, jets, or rockets; however, our scale models fly without motors or engines. PSS sailplanes look like powered airplanes, but the models are gliders that fly in slope lift created by wind blowing into the face of a ridge or a hill.

TEXT & PHOTOS BY DAVE GARWOOD

The Southern California PSS Festival may be the world's largest annual gathering for pure PSS flying. The eighth annual running of this event was held on May 28 and 29, 2005, by the Inland Slope Rebels (ISR) club of Riverside, CA. Cajon Summit is a marvelous slope-soaring venue. The flying site is a long ridge 950 feet above the Cajon Pass in the San Bernardino National Forest, 65 miles northeast of Los Angeles. This flying site's reliable winds are created almost daily when the sun heats up the high desert to the east and convection draws air through the Cajon Pass and up the face of the ridge. It's common here to have 20 to 30mph winds blowing straight into the slope all afternoon.

For this year's event, 48 pilots from seven states registered, and approximately 200 PSS sailplanes were shown and flown. Many started flying on Thursday at Point Fermin, a legendary coastal slope-flying site in San Pedro on the Palos Verdes peninsula about 10 miles south of the Los Angeles Airport. Many who travel to the PSS Festival, especially those from the Midwest and the East Coast, welcome the chance to fly over the Pacific Ocean as part of a slope-soaring trip. Fermin did not disappoint, as the lift was good in the afternoon, and about 20 fliers

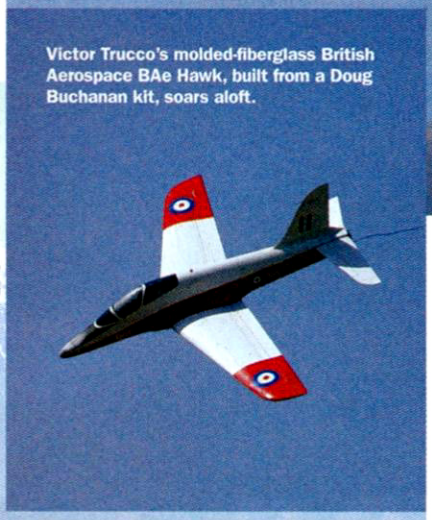
PSS FESTIVAL 2005

from all over California, Hawaii, Kansas, New York and Wisconsin were able to fly every model they brought.

Saturday and Sunday were official event days, with the heaviest activity occurring on Saturday. Friday (pre-event fun day) and Saturday were sunny and warm, with the lift turning on by noon and building to 15 to 20mph for the duration of both afternoons. Sunday morning found the Cajon Summit in fog, and some of the assembled pilots headed to flying sites at lower altitudes, while others stayed until the fog cleared and had a fine flying afternoon on an uncrowded, primo slope. All three days of the event had suitable winds and good lift for all or most of the day.

The event schedule itself is laid back. The only rules are, first: fly nothing but PSS gliders from noon to 6 p.m., and second: fly the faster planes on the hill to the left; slower planes on the hill to the right. No combat is allowed during the event. There is a judged contest with awards (first through fifth places) in four groups: best jet, best propeller plane, best civilian plane and best foam plane. Two additional awards are given: an expert class award (first through third places) to entice the highly experienced builders away from other classes and give newer builders and pilots a better chance to win or place; and a craftsmanship award, honoring builders who really go above and beyond in building and finishing their models.

This Focke-Wulf FW-190D from a Jeff Fukushima Vortech Models kit was built and flown by Carl Maas Jr.



Victor Trucco's molded-fiberglass British Aerospace BAe Hawk, built from a Doug Buchanan kit, soars aloft.

Soaring against a backdrop of the San Gabriel Mountains. This view faces southwest from the "main hill."

A moving tribute to Eric Molstead, a phenomenal PSS scale modeler, was given at the pilots' meeting. Eric died in a plane crash just before the Festival, and he was sadly missed by all. His Cessna Citation model was brought to the Festival, and it won the Best Civilian class.

A building demonstration and clinic took place on Saturday afternoon. Robert Cavazos of Composite Systems Design (rcglider.com) showed in detail the steps required to make his exquisite molded-warbird and slope-jet fuselages.

In addition to the flying, the building demonstration and the awards, we enjoyed a memorable lunch courtesy of Lori Maas of ISR on Saturday, and we got plenty of thrills during daily Slope Scale Parties in which six, eight, 10 or more high-wing-loading PSS

This Vought F4U Corsair, Brian Laird's EPP-foam design, was built and flown by Rick Schwemmer.

Brian Courtice's North American P-51 Mustang is an example of a factory-built and -finished model from Leading Edge Gliders.

Cajon Summit 2005 Winners

PLACE	NAME	AIRPLANE	ORIGIN
>> Expert			
1	**RICHARD SPENCER**	Messerschmitt Me 109G	Scratch-built
2	Jeff Vosburg	Messerschmitt Me 209	Scratch-built
3	Brian Laird	Messerschmitt Me P1101	Scratch-built
>> Best Foam			
1	**DAVID MASSONGILL**	Lippisch	Scratch-built
2	David Kasper	Messerschmitt Me 109	Leading Edge Gliders kit
3	Marty Hill	Curtiss P-40 Warhawk	Leading Edge Gliders kit
4	Kevin Huckins	Kawasaki Hein	Leading Edge Gliders kit
5	Eric Molstead	"Legend"	Leading Edge Gliders kit
>> Best Prop			
1	**PAUL MASURA**	Kawasaki Ki-84	Scratch-built
2	Joe Cormier	Messerschmitt Me 109E	Scratch-built
3	Dave Massongill	Bell P-39 "Pinball"	Cavazos Sailplane kit
4	Brian Courtice	Bell P-63	Cavazos Sailplane kit
5	Ian Gittins	R-4 "Firecracker"	Cavazos Sailplane kit
>> Best Jet			
1	**DAVID CAIRNS**	Boeing B-52 Stratofortress	Scratch-built
2	Brian Laird	Canadair Tutor	Highly modified kit
3	Brian Koester	Sukhoi SU-35	Scratch-built
4	Kevin Huckins	Lockheed F-80 Shooting Star	Composite Systems Design kit
5	Gregg Smith	Northrop F-20 Tigershark	Composite Systems Design kit
>> Best Civilian			
1	**ERIC MOLSTEAD**	Cessna Citation	Scratch-built
2	Brian Laird	Caravelle Jet	Scratch-built
3	Ralph Robert	Bugatti Racer	Scratch-built
4	Rick Schwemmer	Bell P-39 Aircobra	Cavazos Sailplane kit
5	Steve Greenfield	Focke-Wulf TA-152	Tuff Planes kit

Carl E. Maas Craftsmanship Award: Richard Spencer, Messerschmitt Me 109G
Journalism Award: Dave Garwood
Photography Award: Joe Chovan

PSS FESTIVAL 2005

planes flew formation stall turns on both ends of a "half-pipe pattern" in an extreme adrenaline-rush flying session. A loosely organized social event was scheduled Saturday night at the Beer Hunter in Ontario, CA. An evening social is a new activity for the PSS Festival and is likely here to stay.

Those attending the event were delighted to see some extreme high-end modeling and some superb flying. The following deserve special mention:

David Cairns' large-scale Boeing B-52 Stratofortress was impressive on the ground because of its size and scale fidelity, and it was a wonderfully smooth flyer in the air. David's airshow included rolls and extended inverted flight. With engine nacelles hanging beneath the wing, the huge plane is not trifling to land, but Dave got it down with a minimum of damage.

Brian Koester loves the Sukhoi Su-35 Super Flanker and has continued to develop his original design to obtain improved flight performance. This year, Brian flew his third-generation Super Flanker, and it not only looked great but flew magnificently as well.

Richard Spencer's beautifully detailed EPP scratch-built Messerschmitt Me 109G looked great and flew very well. He took first place in the Expert Builder class and won the Carl E. Maas Craftsmanship Award with this highly detailed model.

Jeff Fukushima flew his large-scale, super-detailed molded F4U Corsair, available as a kit from Vortech Models (geocities.com/vortechmodels). Other memorable molded-fiberglass models included Vic Trucco's Doug Buchanan BAe Hawk (a kit that unfortunately is out of production) and Greg Smith's very speedy, molded-fiberglass Northrop F-20 Tigershark, built from a Composite Systems Design kit by Robert Cavazos.

Brian Laird continues to push the envelope in scale EPP-foam designs. For his EPP-foam Corsair, Brian bulked up the fuselages and slimmed down the wing chords to yield another great-looking foamie warbird. Rick Schwemmer built one, and the two Corsairs were flown together—an image that evoked the island-hopping airwar fought in the Pacific Theater during WW II. These planes are covered with Solartex iron-on covering and then painted, panel-lined and weathered, allowing originality and variety in finishing. Another memorable foam warbird was Brian Courtice's Leading Edge Gliders P-51 Mustang.

The ISR SoCal PSS Festival is an epic event at a wonderful flying site, sponsored and attended by outstanding people. If you like flying PSS sailplanes and are inspired to see the work of expert builders and watch the moves of truly cool flyers, you'll want to attend one of these annual events.

For information about next year's event when it becomes available, see the ISR website at inlandsloperebels.com. For more photos of the PSS Festival, see soaringusa.com/images/misc/pss2005/, which is also linked from the ISR website.

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Sky King RC Products
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Tower Hobbies

David Cairns' B-52 appears to beat the traffic on the interstate far beneath it. Below left: Carl Maas Jr. and David Cairns carry the B-52 to the judging area. Below right: Carl and Ralph Roberts launch the Stratofortress for judging.


I found it a joy to build
AND A BLAST TO FLY.

BY GERRY YARRISH || PHOTOS BY DERON NEBLETT, PETE HALL & GERRY YARRISH

GREAT PLANES

STEARMAN PT-17 ARF

A classic military trainer in 1.20-size

When it comes to military trainer biplanes, none is more well-known than the Stearman PT-17. More than 10,000 of these rugged, fairly easy to fly primary trainers were built by the end of WW II. Today, they are still very popular in the stock military configuration and in the higher performance version—the Super Stearman—that's used by various airshow and sky-writing teams. With such a long and positive history, it's little wonder that so many RC Stearmans have been built.

SPECIFICATIONS

MODEL: Stearman PT-17

MANUFACTURER: Great Planes Model Mfg.

TYPE: biplane

LENGTH: 57 in.

WINGSPAN (top/bottom): 71.5/69 in.

WING AREA (top/bottom): 762/704 sq. in.; 1,466 sq. in. total

WEIGHT: 12.4 lb.

WING LOADING: 19.48 oz./sq. ft.

ENGINE REQ'D: .91 to 1.08 2-stroke or .90 to 1.20 4-stroke

RADIO REQ'D: 4-channel with 5 servos

PRICE: $379.98

HIGHLIGHTS

- Builds fast
- Great flight performance
- Built up lighter than advertised

TEST GEAR

RADIO: Futaba 9CAP transmitter and Futaba R149DP PCM receiver, 5 S9001 servos

ENGINE: O.S. 1.20 Surpass 4-stroke

FUEL: Wildcat 15-percent nitro

PROP: APC 16x8

COMMENTS

A very nicely made dummy radial engine covers the front and all but completely hides the 4-stroke engine.

AN IDEAL FIRST BIPE

Between 1/6- and 1/5-scale, the new Great Planes military PT-17 ARF sports an N2S Navy paint scheme and has a manageable top wingspan of slightly less than 6 feet. For those who want to get into biplanes, it is well suited to a .90 to 1.20 4-stroke engine and is a close cousin of the popular 4-aileron Great Planes Super Stearman. The twin-cockpit military version of the Stearman (with ailerons only on the bottom wing) would make an ideal first choice.

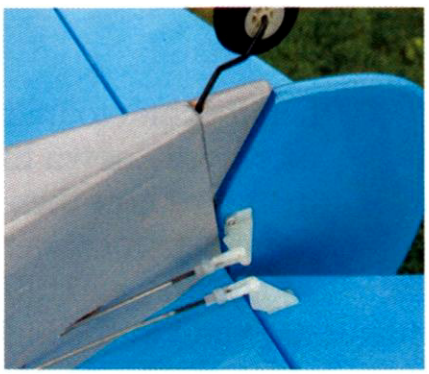
IN THE BOX

The Stearman comes with everything you need. All of the wood parts are nicely laser cut and precisely assembled. Included are the fuselage, four wing panels, vertical and horizontal tail surfaces, scale landing gear, wheels and wheel covers, cabane and interplane ("N") struts, an engine mount, two painted pilot figures, two painted, formed windshields, stick-on decals including rivet details and instrument panels, a complete hardware package, a fuel tank and a dummy radial engine. All you have to add is a 4-channel radio, 5 servos (2 for the ailerons), an engine and basic adhesives.

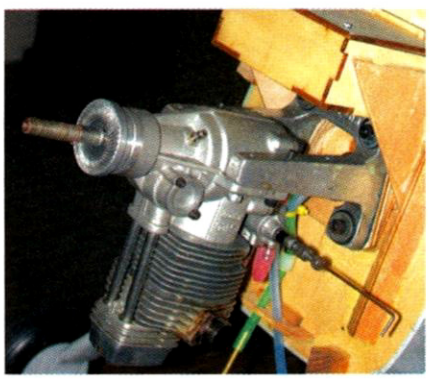
ASSEMBLY

Putting the Stearman together is very easy, and all of the parts fit together nicely. Assembly starts with the wing panels; to ease assembly a bit, I installed the ailerons and the aileron servos before I glued the wing panels together. Strings come taped inside the panels to pull the servo leads into place. The wing joiners are made out of three layers of 1/8-inch-thick plywood that you have to laminate together. I used Great Planes medium CA to laminate the joiner pieces together and 15-minute epoxy to glue the joiners into place and to join the wing panels. The top wing uses the straight joiner, and because it has the dihedral, the bottom wing uses the angled joiner.

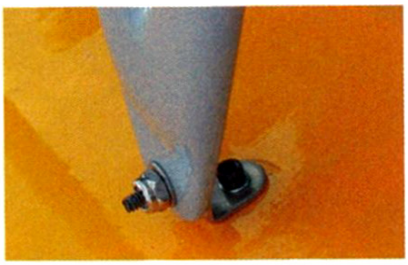
Once the wings have been joined and the glue has cured, install the bottom wing-hold-down bolt plate, and test-fit the bottom wing to the fuselage. If needed, enlarge the bolt holes so that the wing fits easily into place. This is also a good time to install the



All the hardware needed for the Stearman comes in the kit. Here, you see the rudder and elevator pushrods and the control horns. Note the small fuselage tailpiece that covers the steerable tailwheel assembly. It is glued into place after the rudder and tailwheel have been installed.



The O.S. 1.20 fits nicely on the firewall. To add needed nose weight, I replaced the plastic mount that comes with the kit with a metal one. I installed the battery pack in the weight box that's positioned above the engine.



The interplane wing struts are held in place with metal L-brackets and 4-40 cap-head machine screws. The blind nuts are already installed in the wing for you.

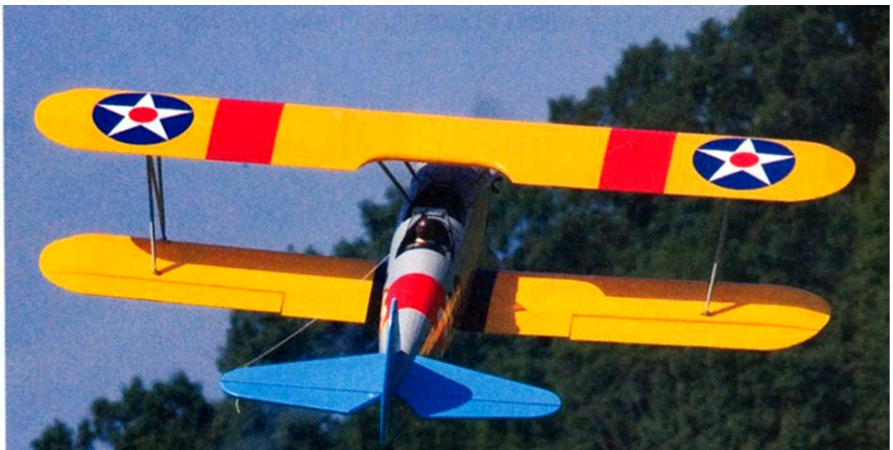
metal attachment brackets to the wings for the interplane struts. All the brackets bolt into place with 4-40 socket-head bolts. The blind nuts are already installed in the wing.

Fuselage assembly begins with the attachment of the main landing gear. Five socket-head bolts hold the gear in place; a balsa cover block hides the landing gear center section. I used PFM adhesive to tack-glue the block into place. To finish the basic fuselage structure, install the tail surfaces and the tailwheel assembly. Align the horizontal stabilizer with the bottom wing, and make sure that the vertical fin is square to the stabilizer. I installed the fuselage tail-fairing block after I had attached the rudder and elevators to the tail surfaces.

TOP-WING ATTACHMENT

I was very impressed by how easily the top wing fit into place. First, bolt the two interplane struts to the top wing, and then loosely bolt the cabane struts into place. Arrow decals show the proper strut orientation. Place the wing and strut assembly onto the fuselage, and slip the bottom attachment bolts into the interplane struts and the attachment brackets. Position the cabane struts so that their lower tabs fit flush against the fuselage sides, and mark the hole locations. Make sure that the upper and lower wing leading edges are parallel to each other, and use a large T-pin to check that the cabane-attachment holes are over the hardwood blocks glued inside the fuselage. If they are, go ahead and drill the screw holes. Screw the cabane struts into place, tighten all the strut-attachment bolts and recheck the wing alignment.

Remove the wings and cabane-attachment screws; then apply a dab of thin CA to the screw holes to harden the threads in the hardwood blocks. Reattach the cabanes, and check the wing alignment once more. You can't check it too often! Once you are satisfied with everything, remove the wings and assemble the carry handle that you bolt to



In the Air

Powered by a non-pumped O.S. 1.20 Surpass 4-stroke engine turning an APC 16x8 prop, an O.S. F glow plug and Wildcat 15-percent nitro fuel, the Stearman PT-17 has a good balance of power and maneuverability. Acceleration during the takeoff roll is spirited, and the model can leap off the ground without fear of a departure stall. Once it breaks ground, very little backpressure is needed to maintain a moderate climb angle.

RECOMMENDED CONTROL THROWS:

- **ELEVATOR:** ±1½ in. (high); ±1 in. (low); expo: -30%
- **AILERON:** ±1½ in. (high); ±1 in. (low); expo: -20%
- **RUDDER:** 1½ in. left/right (high); 1 in. left/right (low); no expo

GENERAL FLIGHT CHARACTERISTICS

- **STABILITY:** with the center of gravity at the proper location, the model has good pitch and roll stability. On low rates, it's undemanding to fly, and at high rates, you have good control authority to do any maneuver you like.
- **TRACKING:** both on the ground and in the air, you will find that the model is well behaved. When you advance the throttle, the nose swings slightly to the left, but this is very easy to correct for, and after only a few takeoffs, it becomes second nature. You should have some previous tail-dragger experience. In the air, the model tracks solidly through most maneuvers, especially if you coordinate rudder and aileron inputs.
- **AEROBATICS:** for most maneuvers, I set elevator on low rate and aileron at high rate. Full-power loops are effortless, and the roll rate is comfortable. I used separate aileron channels and mixed in about 20-percent differential, so rolls are fairly axial with judicious use of elevator. At the recommended balance point, the model is slow to snap using rudder and elevator. Adding some aileron speeds rotation a bit. Inverted flight is easy but requires a bit of forward stick to maintain straight and level.
- **GLIDE PERFORMANCE:** with the power pulled back, all biplanes come down in a hurry because two wings produce a lot of drag. For landing approaches, I shoot final at ¼ to ⅓ throttle and set the model up for flare just as it reaches the end of the runway. The Stearman settles in nicely.
- **STALLS:** with reduced power, the model stalls with a definite break, and if entered level and into the wind, it just lowers its nose to regain airspeed. With a little headwind, I found that the airplane holds on for a good long time with the stick all the way back. Stalled to enter a spin, the model can really wind up for an impressive ride until you release the controls to exit.

PILOT DEBRIEFING

Overall, the Stearman is well balanced and undemanding to fly. Flown at a recent warbird event, the 1.20-powered Stearman kept up with the pack and could slow down nicely for touch-and-go's. Slow flybys were picture perfect, and several pilots took turns at the sticks. Everyone loved flying the PT-17. This model would make a great first biplane for anyone who has a bit of tail-dragger experience.

the top of the cabane struts. This plywood handle doubles as a storage system for the interplane struts, and it helps prevent the cabanes from becoming bent or damaged during model storage.

ENGINE AND RADIO INSTALLATION

I chose a well-used O.S. 1.20 4-stroke engine for power and to add a bit more nose weight (always a good thing for short-nose bipes). I replaced the stock plastic engine mounts with a one-piece aluminum mount. The prop-hub-to-firewall distance is 6¼ inches, and the 1.20 engine fit with room to spare. For the throttle linkage, I drilled a ¼-inch hole in the firewall and used a solid-metal pushrod without a plastic guide tube. To complete the linkage, I used Du-Bro Kwik Connectors on both ends of the pushrod. To add even more weight to the firewall, I built the included plywood weight box and epoxied it to the firewall just above the inverted engine. I drilled a hole through the box and the firewall so I could install my 1500mAh battery pack in the box. To make sure that the box stayed put, I also secured it to the firewall with screws and added plywood gusset braces to both sides of the box.

The engine cowl is actually a formed fiberglass enclosure that looks like the front of the fuselage. It is attached with screws to hardwood blocks glued to the outer edges of the firewall. A very nicely made dummy radial engine covers the front of this enclosure and all but completely hides the 4-stroke engine. Some of the silver paint on the dummy radial chipped away as I cut the openings in it for the 4-stroke, so I sprayed Top Flite LustreKote clear paint on the dummy engine to prevent further chipping. Once you cut the openings in the radial engine, position it on the front of the engine enclosure, and glue it into place. I used Great Planes 15-minute epoxy that I thickened with micro balloons. The scale engine rocker tubes are made of aluminum tubes that come with the kit.

After I had installed the fuel tank and the required plumbing for a three-line setup, I added the radio gear and the pushrods. I used a Futaba 9CAP PCM transmitter with 9001 servos. I deviated from the instructions and installed two elevator servos instead of attaching the two elevator pushrods to a single servo. This required moving the throttle servo forward and attaching it to the removable receiver/battery tray and one of the fuselage bulkheads. This modification is very minor but doubles servo power and adds some redundancy to elevator control. Fully assembled (and without any ballast weight added), my setup placed the balance point exactly at the recommended 5½ inches back from the top wing leading edge.

PHOTO COURTESY OF EXPERIMENTAL AIRCRAFT ASSOCIATION

The Stearman Model-75

In the mid-1930s, the U.S. Army Air Corps needed a new trainer, and in 1936, the Army bought 26 biplanes from the Boeing Aircraft Co., which had just acquired the Stearman Aircraft Co. Powered by a Lycoming R-680 radial engine, the new primary trainer was quickly renamed the PT-13. These engines were soon replaced by the Continental R-670, and the biplane was designated the PT-17. Throughout its service, the biplane was referred to by many names: "the PT" by the Army, "the N2S" by the Navy and "the Kaydet" by Canadian forces. Officially known as the "Boeing Model-75," the PT-17 was often simply referred to as the Stearman.

With a top speed of 124mph, a cruise speed of 106mph and a range of roughly 500 miles, the Stearman was an easy-to-fly, ruggedly built aircraft. By the end of 1945, more than 10,000 airframes had been built. The Stearman went on to become a very popular surplus aircraft that many freshly discharged pilots bought for their civilian aviation careers. Throughout the '50s and '60s, PT-17s found work as mail planes, crop-dusters, training aircraft, advertising-banner towplanes and even barnstorming show planes. Today, there are more than 1,000 of them still in flying condition.

In 1942, the average cost of a PT-17 was about $9,800; today, one will set you back between $75,000 and $100,000, depending on its condition—not bad for such a well-used trainer aircraft!

Specifications

ENGINE: 220hp Continental R-670-5 piston radial engine

WEIGHT: 1,936 lb. (empty), 2,717 lb. (max. takeoff)

WINGSPAN: 32 ft. 2 in.

LENGTH: 24 ft. 3 in.

HEIGHT: 9 ft. 2 in.

Performance

MAX SPEED: 124mph

CEILING: 11,200 ft.

RANGE: 505 miles

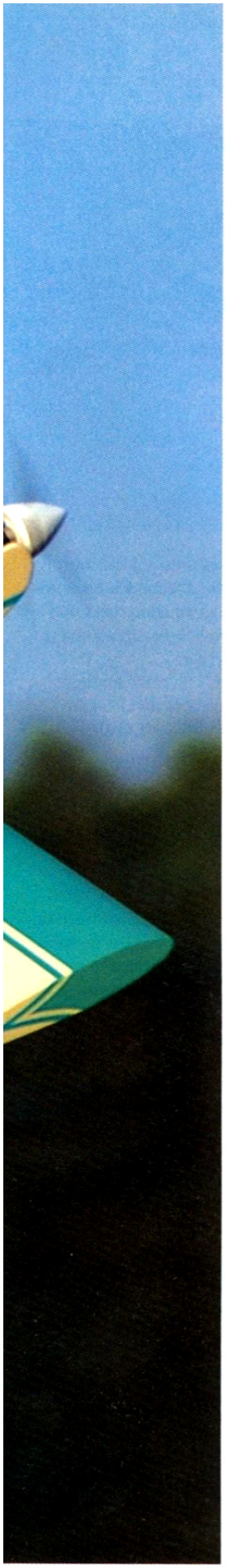
FINAL ASSEMBLY

I added the cockpit coaming to the edges of the cockpit openings, glued the windshields into place and glued one of the two pilot figure into the back office (I left the "student" at home so I could install the radio switch harness and charge receptacle in the empty front cockpit). Attaching control horns and clevises and setting up the control throws finishes the building. All that's left is to apply the two decals and to the fake flying wires. To keep things simple, I did not install the elastic rigging wires.

If you want a great-looking primary trainer biplane, the Great Planes PT-17 in military dress is hard to beat. I found it a joy to build and a blast to fly! ✦

See the Source Guide on page 151 for manufacturers' contact information.


"The Little Extra is a ball to fly and is capable of very EXTREME PERFORMANCE."
Little EXTRA
Little EXTRA



[FlightTest]

BY PETER ABBE || PHOTOS BY PETER ABBE & STEVE MARSH

HERR ENGINEERING LITTLE EXTRA

Extreme aerobatics in a compact package

High-quality construction and an impressive level of engineering have long been trademarks of Herr Engineering, and the new Little Extra ARF lives up to those standards. Everything—from its lightweight construction and detailed assembly manual to its packaging—reveals Herr's attention to detail and pride in workmanship. With an assembly time of only a few hours, this performance-packed ARF is sure to appeal to any ½A enthusiast who wants extreme aerobatics in a compact package. This delightful plane is distributed by Sig Mfg.

SPECIFICATIONS

MODEL: Little Extra
MANUFACTURER: Herr Engineering
DISTRIBUTOR: Sig Mfg.
TYPE: ½A fun-fly
WINGSPAN: 36.5 in.
WING AREA: 344 sq. in.
LENGTH: 34 in.
WEIGHT: 27 oz.
WING LOADING: 11.3 oz./sq. ft.
POWER REQ'D: .061 to .074 2-stroke
RADIO REQ'D: 4-channel w/5 microservos
PRICE: $100

HIGHLIGHTS

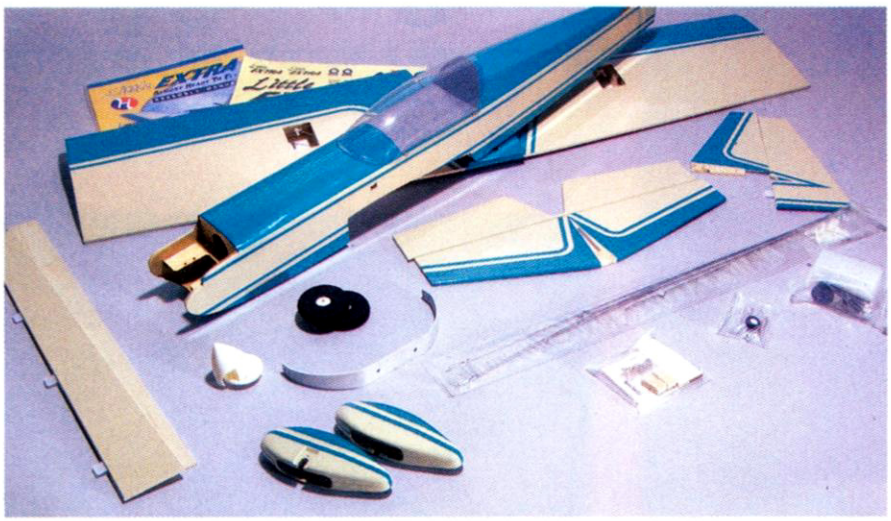
- Built-up laser-cut wood construction
- Virtually all hardware is supplied
- Superfast assembly time

GEAR USED

RADIO: Hitec Optic 6 transmitter, Hitec Electron 6 receiver, 5 Hitec HS-55 servos
ENGINE: Norvel .074
PROP: 7x3 APC
FUEL: 15% Powermaster

COMMENTS

The Little Extra is a high-performance ½A fun-fly model that's well-suited to intermediate and advanced fliers. This lightweight, built-up ARF can be assembled in 4 to 6 hours.



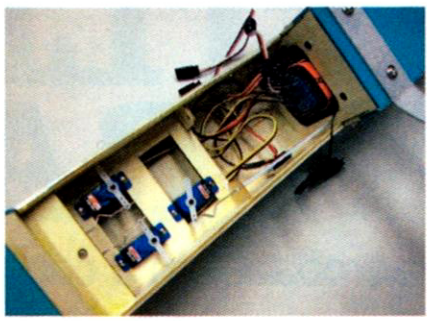
LET'S GET STARTED

The Little Extra comes in white-and-violet and cream-and-turquoise trim schemes. My plane arrived very nicely packed and undamaged. All of the built-up components are light and true, and they come expertly covered and trimmed with wrinkle-free AeroKote. The hardware includes pushrods and keepers, control horns, Sig micro Easy-Hinges, a fuel tank, aluminum landing gear and wheels, painted plastic wheel pants, a spinner and prop-shaft adapter and all required nuts, bolts and screws. The 15-page instruction manual is very comprehensive and details assembly with many clear photos and diagrams; a decal sheet is provided for finishing the model. Also provided is a one-page instruction sheet that explains how to convert the Little Extra to brushless electric power.

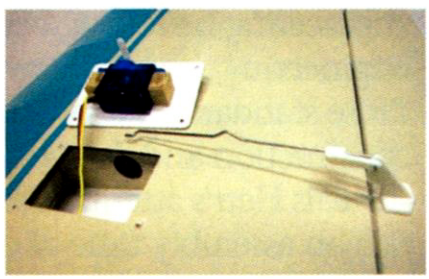
To get your Little Extra ready for flight, you'll need only glue, a 4-channel radio with 4 microservos and a .061 to .074 2-stroke engine .

Wing The one-piece wing takes little more than an hour to complete. After you've hinged the ailerons, glue the supplied micro control horns into laser-cut holes in the control surfaces. The ailerons are actuated by independent servos that are mounted on plastic plates and screwed into the bottom of the wing. Threads are provided to route the servo wires to the center of the wing. The pushrods are 1mm prebent wires, and you can easily adjust them by opening or closing a small V-bend. You use a small plywood aileron-position guide to set the proper angle of each aileron relative to the top of the wing.

Tail feathers The fin keys into the stabilizer to ensure accurate alignment. After you've epoxied both pieces into the tail of the fuse-



The fuselage provides ample room for the HS-55 servos. The Electron 6 receiver and 270mAh receiver battery pack are installed in the nose.



The aileron servos are screwed to two, small, hardwood blocks that must be glued to the plastic servo hatches. The linkages are short, tight and easily adjusted using the V-bends in the wire pushrods.

The Little Extra is engineered around the Norvel .074; even the spinner is supplied with an aluminum adapter to accommodate its prop shaft.

lage, hinge the elevator into place. The next step is to notch and drill the rudder to accept the tailwheel assembly; then hinge the rudder to the fin. The tailwheel wire is retained by a small brass plate that's screwed into the base of the fuselage. The rudder and elevator control horns are mounted on their respective surfaces in the same manner as the aileron horns.

Fuselage To start, install the supplied fuel tank and your microservos. The tank fits snugly into position and is held in place by a small balsa stick. Keep the metal fuel lines fairly short to provide ample clearance between them and the rear of the engine. My HS-55 servos dropped perfectly into the laser-cut servo trays. They're attached to the control surfaces with prebent pushrod wires that ride in preinstalled Nyrods. For control, I chose Hitec's compact, dual-conversion Electron receiver. This light unit fits easily inside the Little Extra's fuselage. Using the supplied bobbin, I shortened the Electron's antenna to a manageable length without compromising its range.

All exposed wood from the firewall forward, including the laser-cut plywood engine mount that is predrilled to match a Norvel .074's bolt pattern, has been fuelproofed at the factory. If you use this engine, you can just drop it into place and screw it down with the supplied screws. The landing gear is bolted to the base of the fuselage with two bolts, and the wheels, axles and wheel pants are attached to the gear in a matter of minutes. The canopy is factory installed, and I mated the wing to the fuselage without any adjustments; it fit perfectly.

FINISHING UP

After I added ½ ounce of lead to its nose, the model balanced according to the specifications. Following the "wet application" method recommended in the manual, I applied and positioned the decals without any problem. If you choose to apply them dry, I must warn you: when they're stuck, they're stuck!

CONCLUSION

Herr Engineering's Little Extra is an outstanding example of fine model engineering. It is complete, well built and superfast to assemble. If you're looking for a compact, glow-powered ARF that can tear up the sky, be sure to check this one out. I think you'll be impressed!

See the Source Guide on page 151 for manufacturers' contact information.

In the Air

After half an hour of run time, I found the little Norvel .074 engine to be very reliable. It transitioned smoothly from idle to full throttle.

CONTROL THROWS:

- **AILERONS:** ±½ in. (low), -20% expo; max. deflection (high), -50% expo
- **ELEVATOR:** ±¾ in. (low), -30% expo; max. deflection (high), -50% expo
- **RUDDER:** ±⅛ in. (low), 0% expo; max. deflection (high), -40% expo

GENERAL FLIGHT CHARACTERISTICS

- **STABILITY:** the Little Extra is very stable yet very responsive. It's easily tossed around in breezy conditions, but its large control surfaces help maintain positive control.
- **TRACKING:** tracking on short grass and on pavement is very good. A touch of right rudder keeps things nicely lined up on takeoffs. The wheel pants and small wheels do tend to get hung up in taller grass.
- **AEROBATICS:** extreme aerobatics are well within the Little Extra's reach. Loops must be kept relatively tight, and vertical up lines are short; rolling, snapping and tumbling maneuvers are the model's strong points.
- **GLIDE PERFORMANCE:** although the Little Extra is very light, its relatively thick, fun-fly airfoil is not conducive to gliding. It descends gently but quickly when the power is pulled back.
- **STALLS:** nothing to worry about! Pulling hard up-elevator will cause the model to porpoise in a series of short stalls. Unless intentionally held at a high angle of attack, the model will not drop a wingtip; releasing a little elevator backpressure gets it flying again.

PILOT DEBRIEFING

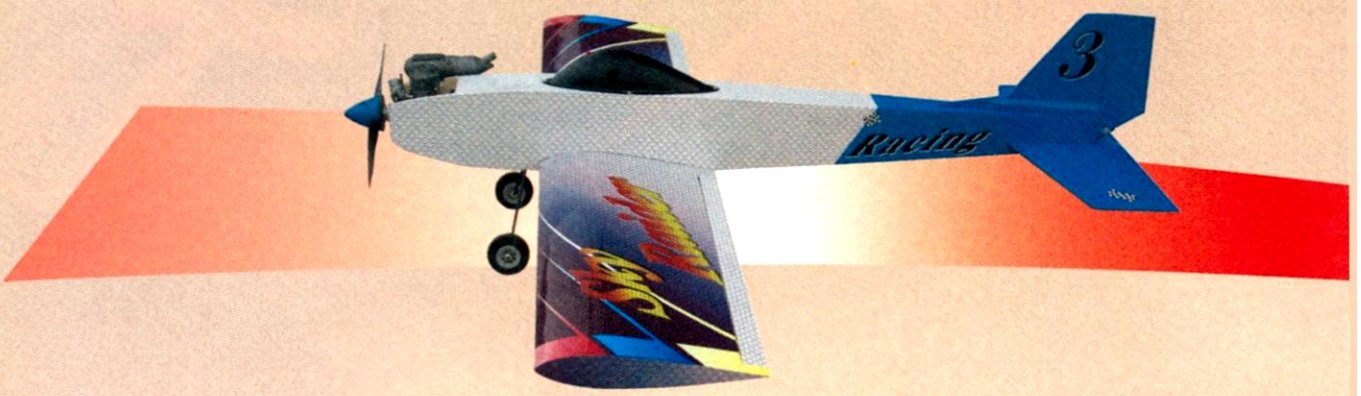
After some experimenting, I settled on using fairly high exponential rates. This kept the model very manageable without compromising its maximum performance. On low rates, rolls and snaps are very fast, and recovery is nearly instantaneous; high-rate rolls are close to three per second. Point rolls, slow rolls and rolling circles are all possible. Moving the center of gravity ½ inch aft made the Little Extra even snappier and improved its tumbling abilities. At maximum rudder deflection, the model showed virtually no roll coupling; however, it did have a strong tendency to pitch towards the gear.

The Little Extra is a ball to fly and is capable of very extreme performance. The wing loading is so low that you really have to do something low and stupid to get yourself into trouble!

It lands at walking speed and can easily be flown in confined places. If you prefer electric power, the Little Extra's size and weight make it an ideal candidate for it.

Sky Raider

Mach II



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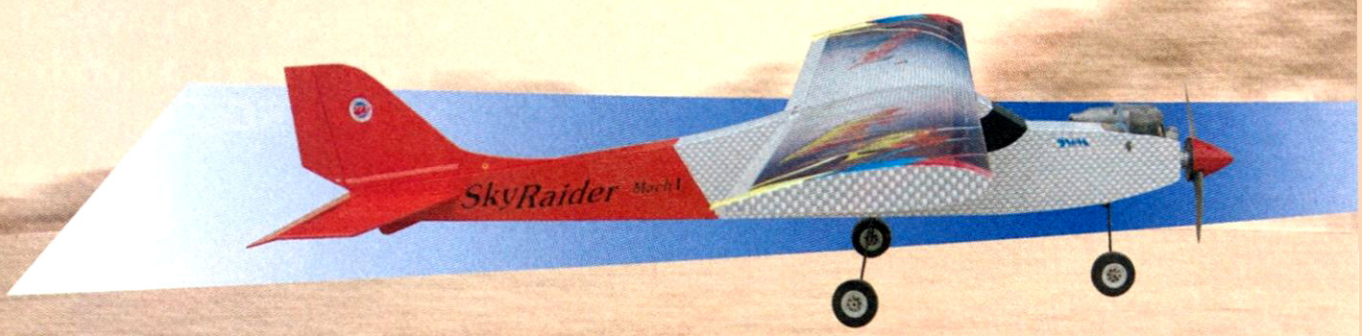


Sky Raider

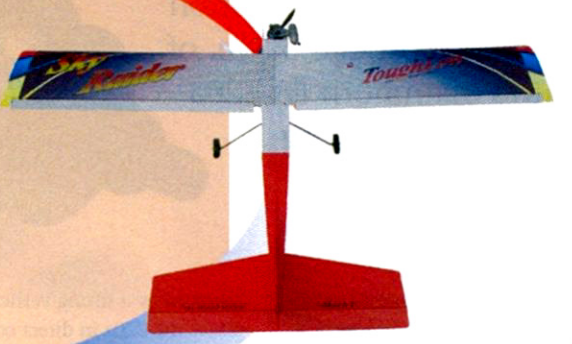
Mach I

Wing Span : 54 in / 1370 mm
Wing Area : 556 sq in / 35.9 sq dm
Flying Weight : 5 lbs / 2200 g
Fuselage Length : 47.5 in / 1210 mm
Engine Required : 2C 0.40 cu in
radio required : 4 channels, 4 servos

- Next step after Mach I
- Low wing aerobatics trainer
- Fully symmetrical airfoil
- Premium hand iron-on covering film
- Stable but maneuverable characteristics
- Comes with all hardware and accessories
- Tail dragger landing gear
- Available in 3 color schemes : Red, Yellow & Blue

$69.99

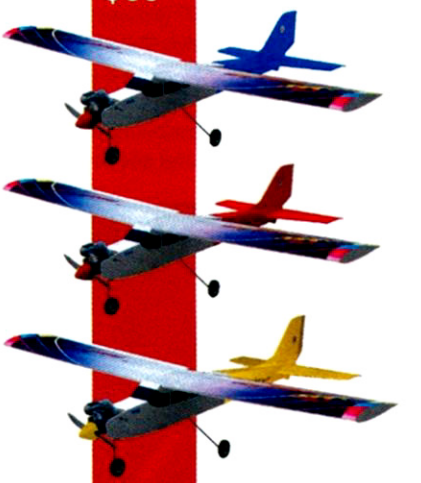
Code No : A178R



Wing Span : 65.5 in / 1660 mm
Wing Area : 725 sq in / 46.8 sq dm
Flying Weight : 5.5 lbs / 2450 g
Fuselage Length : 53 in / 1350 mm
Engine Required : 2C 0.40 cu in
radio required : 4 channels, 4 servos

- Trainer for beginners
- Stable flight and fantastic self - recovery characteristics
- Semi-symmetrical airfoil
- Premium hand iron-on covering film
- Comes wih all hardware and accessories
- Tricycle landing gear
- Available in 3 color scheme : Red, Yellow & Blue

$69.99



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[EngineReview]

BY DAVE GIERKE || PHOTOS BY DAVE GIERKE & DERON NEBLETT

SAITO FA-220a

MIGHTY 4-STROKE MUSCLE

In the world of full-size motorcycles, large-displacement, single-cylinder engines are known as "thumpers." Saito and its North American affiliate, Horizon Hobby, have released a new "thumper" of their own in a 3.4hp, 2.2ci glow-ignition 4-stroke. With almost 400 oz.-in. of torque, Saito's mammoth FA-220a engine is capable of turning 22- and 24-inch-diameter propellers with authority.

Weighing in at 2 pounds 13 ounces (ready to fly, with muffler), the FA-220a produces a power-to-weight ratio of 1.2hp per pound—an outstanding achievement in an industry devoted to lightweight aero prime movers. According to Jim Booker, Horizon's proprietary engine product manager, "The new engine will fly 27-percent-scale [76- to 84-inch-span] models that are currently being powered by 50cc [3.05ci] gasoline engines." He continues, "The engine demonstrates its strong thrust-producing ability by hovering a typical 15-pound aerobatic model, followed by a strong vertical climb." This places the 220a in direct competition with larger, spark-ignition single- and multi-cylinder 2- and 4-stroke designs.

DESIGN FEATURES

The exterior of the Saito 220a consists primarily of aluminum-alloy pressure die-castings. These components are complemented by chrome plating (rocker boxes and air-induction tube), a bar stock, turned-aluminum drive washer and black-plated screw fasteners, prop washer and nut. The

Three machine screws attach the intake manifold to the cylinder head; the glow plug faces towards the rear of the engine. The exhaust manifold is attached to the cylinder head and muffler body with jam nuts.

Saito's expansion chamber muffler performs well, as our test results indicate. Before you fly, secure the connections between the cylinder head and muffler body with thread-lock.

Specifications

ENGINE: Saito FA-220a

DISTRIBUTOR: Horizon Hobby Distributors

DISPLACEMENT: 36.3cc (2.2ci)

BORE: 38mm

STROKE: 32mm

BORE/STROKE: 1.1875:1

STROKE/BORE: 0.84:1

WEIGHT (ENGINE & MUFFLER): 1,275g (2 lb. 13 oz.)

CRANKSHAFT NOSE THREAD: M8x1.25 (ISO)

GLOW PLUG: Saito SS SAIP 400S (replacement: Hangar 9 4-cycle Super Plug)

CARBURETOR CHOKE BORE: 11mm (0.434 inch)

FUEL: custom blend of 15-percent nitro, 20-percent oil (3-percent castor)

LENGTH: 149mm (5.87 in.)

WIDTH: 75mm (2.95 in.)

HEIGHT: 158mm (6.22 in.)

PRICE: $499.99

The updraft fuel-metering carburetor is fitted with a short velocity stack at the intake side of the unit; notice the brass crankcase breather fitting inside the rear cover.

Highlights

- Impressive torque
- Ringed AAC piston and cylinder
- Superb castings, forgings and machine tool work
- Excellent instruction manual
- Included tool kit

one-piece cylinder barrel and head are mounted on the crankcase with four machine screws. The glow plug is positioned inside the cylinder head so that it faces the rear. In traditional Saito fashion, the valvetrain components (cam, gear, tappets, cam-gear housing, pushrods and pushrod covers) are at the front of the engine. Because of the excellent fuel-draw characteristics of Saito's latest engines, the fuel-metering, 2-needle updraft carburetor no longer has a choke valve. The FA-220a is also available in a Golden Knight version with a glossy black finish and gold-plated valve covers.

SLEEVELESS CYLINDER BARREL

All Saito engines are demanding in terms of their manufacture: the one-piece head and upper cylinder barrel eliminate the need for connecting machine screws and head seals, and they continue to impress users of lightweight, reliable engines. Operating without the restrictions imposed by fasteners, Saito's engineers had a free hand in designing for maximum air/fuel-flow performance of the ports leading to and from the intake and exhaust valves. By refusing to compromise

Making Torque & Horsepower

During the dynamometer performance test, the FA-220a was found to produce its best torque (390 oz.-in.) at between 5,000 and 6,300rpm; this is where the largest propeller (an APC 24x8) loaded the engine (see point "A" on the "Torque & Horsepower vs. Rpm" graph, below). Although the engine can, theoretically, turn larger propeller loads, overheating and detonation (a combustion defect) might become a problem. Evidently, the engineers at Saito agree: an APC 22x6 is the largest propeller they recommend (and they like the APC 19x8 prop for use in aerobatic planes). Nevertheless, the engine still produces 2.25 brake horsepower (bhp) while smoothly cranking the 24x8—impressive.

The engine's peak horsepower (3.39 bhp) occurs at 9,570rpm—almost exactly where the APC 14x14 propeller loaded the engine (see point "B" on the graph). If your goal is to go fast with a lightweight, low-drag airplane, this propeller would be a good starting point.

Low-pitch propellers that load the engine toward the peak torque rpm are best suited to relatively slow models such as sport and scale designs. Higher pitch propellers with smaller diameters that allow the engine to "unload" to near the peak bhp rpm are generally best suited to smaller, low-drag airplanes that are intended for higher speeds. There are an infinite number of propeller diameter and pitch combinations that will load the engine within its spectrum of operation. It's your responsibility to find the correct blend of engine and propeller—one that delivers the best possible flight performance—for your airplane. Although there isn't a cookbook for determining the best combination, trial and error combined with an understanding of the engine's performance capabilities will reduce the number of propellers that you'll need to try.

THROTTLING & NOISE

After break-in and dyno tests, I checked the engine for idle and its transition to wide-open throttle. Other than needing to have its low-speed needle valve leaned a bit (¼ turn) from the factory-set position, the engine idled at a consistent 1,600rpm and exhibited a crisp throttle-up after a 30-second idle period. The sound level was a quiet 88dB at 5,510rpm and 92dB at 9,570rpm.

READING THE GRAPH

To determine the torque and horsepower values generated by each flying propeller:

- Locate the rpm for each prop on the "Torque & Horsepower vs. Rpm" graph.
- Draw a line vertically through the torque and horsepower curves.
- Transfer the points of intersection to the scales on the right and left to determine torque and brake horsepower.

Test results

PEAK TORQUE: 390 oz.-in. @ 5,000 to 6,300rpm

SPECIFIC TORQUE: 177.3 oz.-in./ci

PEAK BHP: 3.39 @ 9,570rpm

SPECIFIC BHP: 1.54 bhp/ci

POWER/WEIGHT: 1.2 bhp/lb.

Rpm values

APC propeller	Rpm
14x8	11,200
14x14	9,570
16x12	8,620
18x10	8,200
19x8	8,080
20x8	7,400
18x14	7,400
20x10	7,000
22x6	6,880
21x10	6,250
24x8	5,510

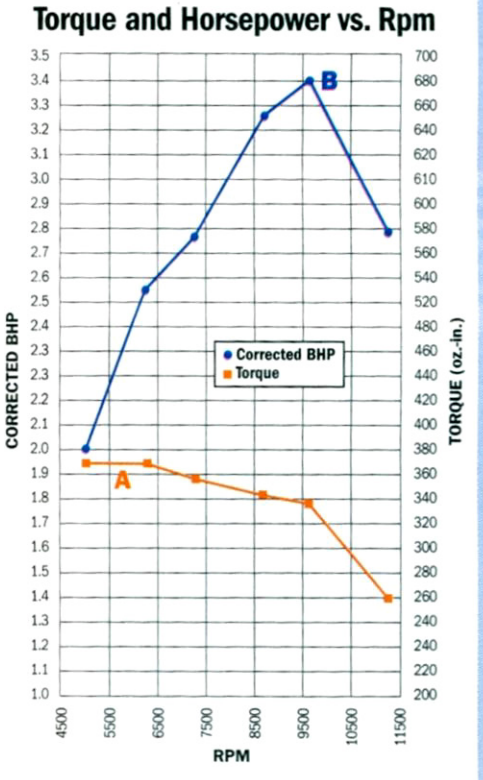
Test conditions

TEMPERATURE: 76° F

BAROMETRIC PRESSURE: 29.46 in. Hg

WET-BULB TEMPERATURE: 65° F

BHP CORRECTION FACTOR: 1.047



HORIZON'S SUGGESTED PROPELLERS:

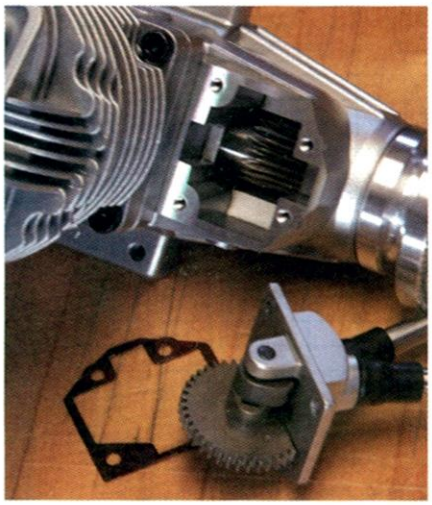
Sport flying: 18x10, 20x6, 20x8, 22x6

Scale flying: 20 6, 20x8, 22x6

Aerobatics: 18x10, 20x6, 20x6w, 21x6, 22x6

The very clean appearance of the engine's valve-train components typifies Saito's approach to mechanical design: simplicity. Notice the removable camshaft/tappet cover—something different on the 220a.

The cast-aluminum-alloy piston is fitted with a fine-grain iron compression ring; Teflon end pads protect the cylinder wall from wristpin damage. The tough aluminum-alloy connecting rod doesn't need bronze bushings at either end to be effective and preserve the engine's longevity.



With the cam cover removed, you can see the gear teeth on the engine's crankshaft; notice the delicate paper gasket that creates a seal between the cover and the engine's crankcase.

the integral head/cylinder barrel, most machine processes are forced to be performed from the bottom side of the barrel, including cylinder boring, honing and direct chrome-plating. This eliminates the need for a separate cylinder sleeve. The combustion chamber (shape) is also machined from the bottom side, and the bronze valve guides and seats are fabricated and press-fit into the head to provide an excellent seal and long operation.

INTERNAL LUBRICATION

Lubricating oil is provided in the fuel; some blows past the piston ring from the combustion chamber and into the crankcase, where it is pumped throughout the crankshaft ball bearings, camshaft, tappets, crankpin, wristpin and connecting rod by the reciprocating action of the piston. Excess oil exits through the breather fitting in the engine's back cover.

CRANKSHAFT AND VALVE TRAIN

The crankshaft is machined in one piece, including the crankpin and integral pinion gear for valve-train actuation. Shaft nose threads are M8x1.25 (ISO). The piston is produced from a casting; it contains a single, non-pinned Meehanite (fine-grain cast-iron) compression ring. The wristpin (free-floating variety) contains Teflon end pads. The connecting rod is made of a forged aluminum alloy; there are no bronze bushings on the wristpin or crankpin ends of the rod.

The 220a is a pushrod-actuated, poppet-valve engine. Besides the half-speed camshaft that is driven from the crank, the system components consist of a camshaft/cam-gear cover and cam gear; two bronze tappet (lifter) guides pressed into place on the top of the cam-gear housing; two hardened and ground tappets; two hardened and ground pushrods; two steel rocker arms with machine-screw rocker-arm pivot pins; and two steel poppet valves with return springs and steel retainer washers.

The rocker-arm brackets that retain the rocker arms by means of the pivot pins are part of the cylinder barrel/head die-casting. The chrome-plated, die-cast, aluminum-alloy rocker-arm covers are held in place by machine screws. The covers are sealed to the head by two paper gaskets. An adjustment screw and locknut allow you to manipulate the valve lash (the clearance between the end of the valve stem and the rocker arm). The engineers at Saito have provided a feeler gauge for this adjustment along with the appropriate Allen wrenches. The pushrods operate within steel tubes (covers) that are sealed at both ends by synthetic rubber endcaps.

Normal engine operation

The Saito manual suggests the following:

- **Don't operate the engine with a lean air/fuel mixture.**
- **After an hour or two of run time, you may need to adjust the poppet valves.**
- **Regularly check all screws and nuts on both the engine and the muffler.**
- **Use a length of silicone tubing attached to the crankcase breather nipple to direct excess oil away from the airplane.**
- **Before flying the FA-220a, secure the exhaust manifold and muffler with "red" thread-lock, such as Pacer Products' Z-71.**

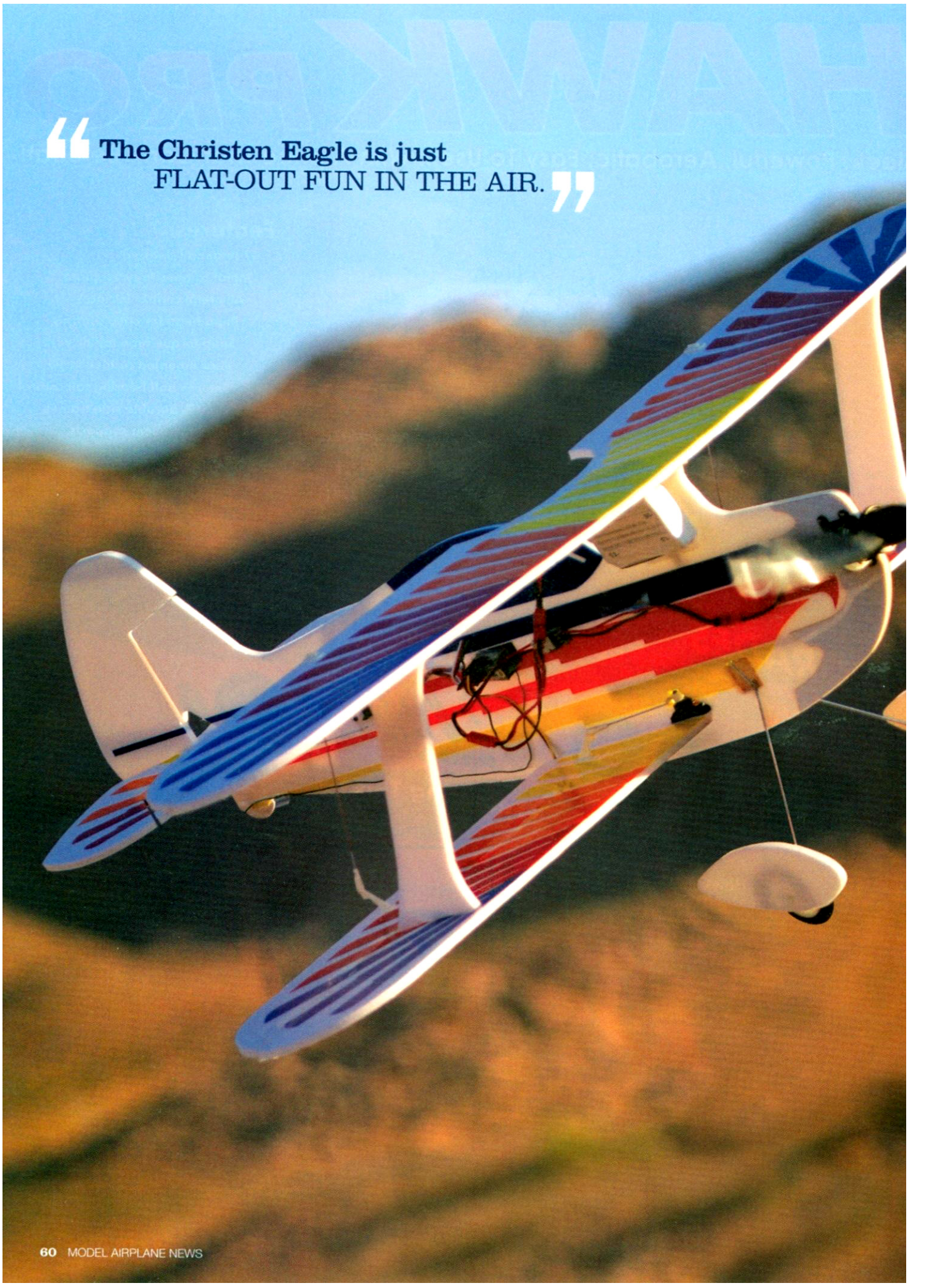
CONCLUSIONS

This superbly designed and fabricated mill uses only the best materials and processes in its manufacture. Saito's ringed AAC (aluminum piston, aluminum cylinder, chrome-plated) unit represents cutting-edge technology for controlling component clearances throughout the wide range of engine-operating temperatures, from wide-open throttle through idle and back again. By eliminating the traditional cylinder sleeve, Saito alone has reduced the number of component interfaces between the piston and ambient air, greatly improving the engine's ability to cool efficiently.

Large, single-cylinder, 2-stroke glow and ignition engines are a common sight at flying fields these days, but big, 4-stroke singles are not. This is about to change! Although detractors often note that 4-stroke engines are heavier than equivalent 2-stroke designs, Saito has been very active over the years in leveling the playing field, as demonstrated by its latest gem: the FA-220a. Four-stroke engines have a soothing exhaust note; they run cooler when properly tuned, and they produce more crankshaft torque at a low rpm for turning big propeller loads. This "thumper" has performance to please. ✈

See the Source Guide on page 151 for manufacturers' contact information.

click trip MODELAIRPLANENEWS.COM FOR BREAK-IN & DISASSEMBLY TIPS


“The Christen Eagle is just
FLAT-OUT FUN IN THE AIR.”

[FlightTest]

BY LARRY COOPER || PHOTOS BY JOHN REID

THUNDER TIGER

CHRISTEN EAGLE

Aerobatic classic with 3D performance

I've been involved with electric planes for quite a while, and I'm at a point now where aerobatics is fun rather than terrifying. I have watched the 3D guys and felt a little envious of what their planes can do, so when I was offered the chance to check out the 3D Christen Eagle from Thunder Tiger, I jumped at it. This plane does amazing things in the air, but it doesn't cost an arm and a leg to own. With a 3-cell battery pack, it leaps into the air, and what it does there is limited only by your imagination. Its bright colors make it easy to see in the sky, and all the flat surfaces allow its pilot to fly with great stability. If you've wanted to check out the wonderful world of 3D flying, you'd be wise to consider this plane.

SPECIFICATIONS

MODEL: Christen Eagle
MANUFACTURER: Thunder Tiger
DISTRIBUTOR: Ace Hobby Distributors
TYPE: 3D profile
LENGTH: 30.9 in.
WINGSPAN: 30.7 in.
WING AREA: 369.8 sq. in.
WEIGHT: 14.7 oz.
WING LOADING: 5.74 oz./sq. ft.
MOTOR REQ'D: Speed 370 w/6:1 (included)
RADIO REQ'D: 4-channel with 3 miniservos
PRICE: $49.95

HIGHLIGHTS

- Outstanding performance
- Great fun to fly
- Grows with its pilot's skill level

GEAR USED

RADIO: Hitec Eclipse 7, GWS RP4II receiver with 3 Ace RC C1016 servos, GWS ICS-300 ESC, Kokam 1500mAh Li-poly battery
MOTOR: Speed 370 motor geared 6:1
PROP: 11x8

COMMENTS:

This plane is a snap to build and can be completed quickly and easily. The Christen Eagle offers great flight performance and can perform complex maneuvers as your skill progresses.

OPENING THE BOX

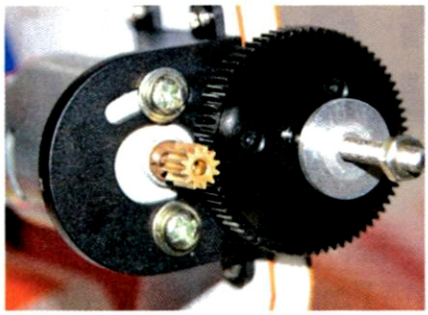
The small box contains all of the major components of a profile-type biplane. The fuselage, wings and tail feathers are all neatly stacked in the box. The landing gear, including two wheels, a mounting block, spring-steel wire, profile wheel pants and the screws come packaged in sealed plastic bags. All of the control horns and linkages are included. A 14-page set of instructions guides you through the assembly and setup procedures. The motor, gearbox and propeller are included, as is all the hardware necessary to affix them to the plane. Two-part epoxy, three-sided balsa and Styrofoam squares are supplied to help keep everything square and secure. Hook-and-loop material and double-stick tape are supplied to secure the servos, battery and receiver.

ASSEMBLY

I began by reading completely through the instructions and inventorying all the parts. The instructions are common to three of Thunder Tiger's airplanes, so you need to be careful to look for the sections that are specific to the Christen Eagle. The instructions are very helpful in assembling the plane, but some of the photos are difficult to make out.

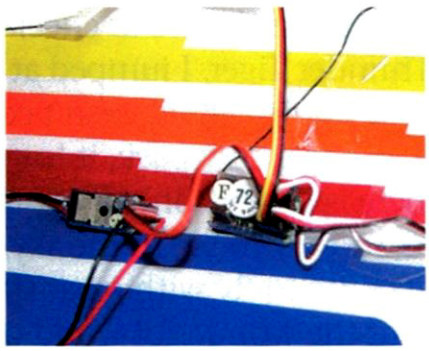
The Christen Eagle is an easy build; I was able to complete it in two evenings. As are all of the components, the fuselage is made of a Styrofoam core with cardboard on each side. There is nothing to build on the fuselage or the wings. The wings are whole units, and the ailerons are hinged with tape at the factory. All of the slots for the control horns have been precut, as are the holes that hold the servos. Once I had installed the servo in the center of the bottom wing, I slid the wing into place, aligned it with the fuselage and epoxied the wing with the triangular rails that help keep it square to the fuselage. While the epoxy cured, I held the wing and fuselage square using the pieces supplied for that purpose. I epoxied the top wing and struts to the fuselage and bottom wing. I installed the control horns with epoxy, following the instructions for their proper orientation, and then I connected all of the linkages from the servo to the lower ailerons. At this point, I simply needed to adjust the length of the linkages on the rods connecting the upper and lower ailerons and snap them into place.

Tail feathers With the wings in place, I installed the horizontal stabilizer and rudder, which come as a single piece hinged at the factory. I simply made a dry fit, checked and marked the bottom for alignment and then epoxied the assembly into place. I used the

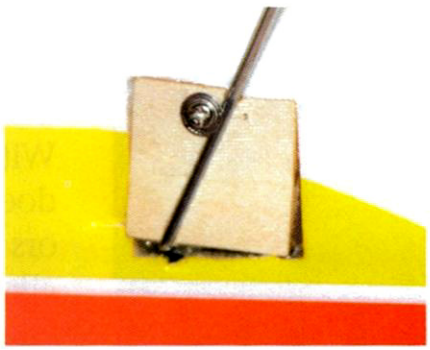


I mounted the motor on the gearbox and then secured it to the fuselage with the supplied hardware.

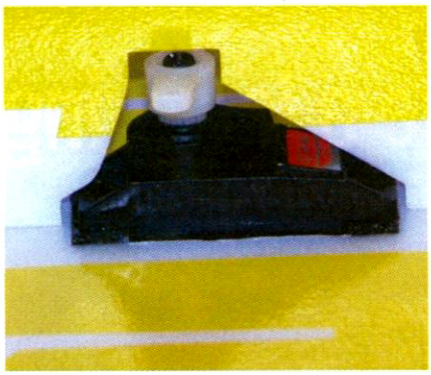
I cut a small slot with a hobby knife and then used 5-minute epoxy to secure the tailskid.



I used hook-and-loop tape to secure the receiver and ESC to the fuselage. Now I'll easily be able to move them if I need to change the CG.



I assembled the landing gear except for one wheel and used 5-minute epoxy to secure the assembly in the cutout in the fuselage.



I installed the lower wing in the fuselage with the aileron servo properly oriented.

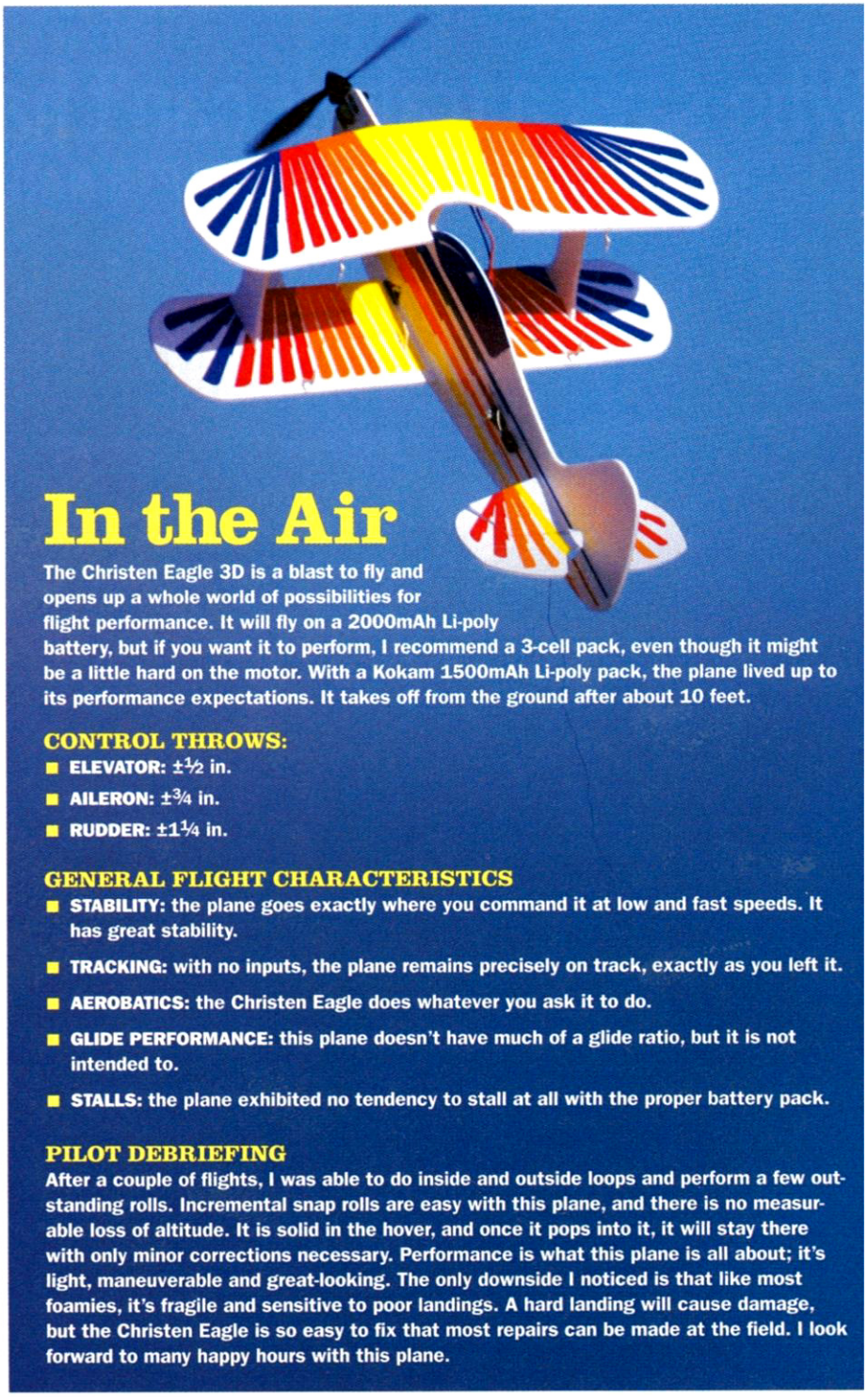
supplied pieces to keep the assembly square to the fuselage while the epoxy cured. The rudder goes on in a snap. I cut and peeled the hinge tape, then carefully placed it on the fuselage and rudder, making certain that it was on the left side of the plane. I then moved the rudder to the full left position and added another piece of tape to the right side.

The servos fit into slots in the fuselage and are held in place with double-stick tape. The supplied linkages fit the rudder and elevator perfectly. I just epoxied the control horns into place and connected the linkages.

Fuselage The fuselage needs little attention. A block holds the landing gear in place. I fit the wire to the block and then epoxied the block into the slot in the fuselage. The wheels are just slipped onto the axles and held in place with special plastic nuts that not only secure the wheels but also act as the bracket for the wheel pants. The wheel pants are secured with epoxy. I cut a slot and epoxied the plastic tailskid gear into place.

Power system The power system comes in pieces with the spur gear on its own shaft, bearings, gearbox frame and motor mount. The pinion is separate from the motor, and it is just press-fit onto the motor shaft. It all assembles easily; the only thing that requires special attention is the alignment of the pinion gear with the spur gear. Before I tightened the motor into its final position, I made certain that a piece of paper fit between the gears. I left the paper in place while I tightened the motor-mounting screws and then rotated the gear to get it out. The motor/gearbox assembly is secured to the plane through the mounting holes and slot on the front of the fuselage. The prop is installed on the gear shaft with the numbers out, just as on any other front motor-mounted plane.

Radio gear and final assembly I chose a GWS receiver and ESC because they are small and light. I attached the receiver and ESC to the fuselage with hook-and-loop tape, and I secured the battery directly under the top wing with another strip of this tape. I cut all of the pieces of hook-and-loop tape used on the fuselage a little longer than I needed them so I could easily reposition all of the components, if necessary, when I balanced the plane.



In the Air

The Christen Eagle 3D is a blast to fly and opens up a whole world of possibilities for flight performance. It will fly on a 2000mAh Li-poly battery, but if you want it to perform, I recommend a 3-cell pack, even though it might be a little hard on the motor. With a Kokam 1500mAh Li-poly pack, the plane lived up to its performance expectations. It takes off from the ground after about 10 feet.

CONTROL THROWS:

- **ELEVATOR:** ±½ in.
- **AILERON:** ±¾ in.
- **RUDDER:** ±1¼ in.

GENERAL FLIGHT CHARACTERISTICS

- **STABILITY:** the plane goes exactly where you command it at low and fast speeds. It has great stability.
- **TRACKING:** with no inputs, the plane remains precisely on track, exactly as you left it.
- **AEROBATICS:** the Christen Eagle does whatever you ask it to do.
- **GLIDE PERFORMANCE:** this plane doesn't have much of a glide ratio, but it is not intended to.
- **STALLS:** the plane exhibited no tendency to stall at all with the proper battery pack.

PILOT DEBRIEFING

After a couple of flights, I was able to do inside and outside loops and perform a few outstanding rolls. Incremental snap rolls are easy with this plane, and there is no measurable loss of altitude. It is solid in the hover, and once it pops into it, it will stay there with only minor corrections necessary. Performance is what this plane is all about; it's light, maneuverable and great-looking. The only downside I noticed is that like most foamies, it's fragile and sensitive to poor landings. A hard landing will cause damage, but the Christen Eagle is so easy to fix that most repairs can be made at the field. I look forward to many happy hours with this plane.

FINAL THOUGHTS

If you are looking for a great flying 3D plane, the Thunder Tiger Christen Eagle is for you. From the moment you first throttle up and jump into the sky until the gentle landing, the Christen Eagle is just flat-out fun in the air. The short build time and great looks add to its appeal. I've made it a priority to use this plane to help me improve my skills, and I bet it will help you, too. ✈

See the Source Guide on page 151 for manufacturers' contact information.

[ProductReview]

BY BOB ABERLE || PHOTOS BY DERON NEBLETT

ELECTRIFLY POLYCHARGE 4

FOUR Li-POLY CHARGERS IN ONE!

A few years ago, you might have asked, "Why would I need a Li-poly battery charger with four outputs?" But today, we enjoy long flights using relatively inexpensive Li-poly packs, and now that we can afford to own more packs, the next question is, how do we recharge them while at the flying field? You could bring a charger for each pack, but the resulting cables might be confusing, and the cost of a bunch of chargers would certainly be steep, to say the least.

Enter the problem-solver! ElectriFly recently introduced the PolyCharge 4, which can independently charge four separate Li-poly packs. The PolyCharge 4 can handle 1- to 4-cell packs with capacities from 300 to 3000mAh. Each of the four outputs is completely separate from the other; you can start charging your packs at different times, and you can use only one or two outputs, leaving the others open.

HOW IT WORKS

The PolyCharge 4 can be powered by 12V DC input power from a car battery or a regulated AC power supply. The 30-inch-long input cable terminates in a pair of alligator clips. The input circuit has reverse-polarity protection and has a 20A automotive-type fuse that you can access outside the case. On the output side, the PolyCharge 4 comes

Specifications

PRODUCT: PolyCharge 4

MANUFACTURER: ElectriFly

DISTRIBUTED BY: Great Planes Model Distributors

TYPE: four-output Li-poly charger

SIZE: 8x5x1¾ in.

INPUT: 12V DC

INPUT CABLE: 30 in., terminating in alligator clips

OUTPUT CONNECTIONS: accepts conventional banana plugs (two required for each output)

CELL CAPACITY: 300 to 3000mAh Li-poly

CHARGE CURRENT: variable from 300 to 3000mA

NO. OF CELLS: 1 to 4 cells (each output)

PRICE: $100

Here is one of the output stations. Just move the rotary dial to match the battery-capacity rating, and the charger will be set to the correct current. Note the start/stop button and multicolored LED that will glow green, red, or orange. The positive and negative banana-jack connectors are at the bottom.

Because I wanted to test the unit's accuracy, I attached my AstroFlight Super Whattmeter II. It indicated that the PolyCharge 4 was accurate and that it operated in a safe, consistent manner.

with two standard banana jacks for each output (eight jacks total).

Operation couldn't be simpler: there aren't any menus to understand or worry about. First, connect the unit to a 12V DC power source. Then connect a Li-poly pack to the output. Set the associated dial to match the battery's capacity (usually on the battery label). A fully discharged Li-poly battery (discharged to approximately 3 volts per cell) will take roughly an hour to reach a full charge (maximum capacity for that particular pack).

To initiate charge, momentarily press the "start/stop" button. An LED just to the left of that button will initially glow green while the PolyCharge 4 senses the pack's voltage and sets itself for the proper number of cells in that pack. This can take about 5 minutes. Then the LED will begin to blink green to indicate the number of cells in your pack. If you attached a 2-cell battery, the LED will blink twice, pause, and blink twice again; that continues until the charge is complete.

When the Li-poly pack is fully charged (at full capacity), an alarm will sound, and the LED will blink red. At that point, you should remove the pack from the charger output. Packs attached to other outputs may continue separately. Keep in mind that for safety, you should never leave a Li-poly pack unattended as it's being charged. You should also never charge the batteries while they're in your aircraft.

TEST RESULTS

Although the PolyCharge 4 doesn't have an LCD screen to provide parameter readouts, I was able to easily insert an AstroFlight Super Whattmeter II in the output cable between the charger and the battery pack. That gave me the opportunity to monitor the actual charge current, the voltage attained at cutoff and the "mAh" that were put back into the pack. I attached a 2-cell, 350mAh pack and set the dial at 350mA current. I measured exactly 340mA for approximately the first 40 minutes on charge, as the voltage continued to climb. After that, the current began to diminish as the voltage slowly increased. After an hour, the current had dropped down to only 50mA while the voltage reached 8.3. That works out to a little less than the recommended maximum of 4.2 volts per cell. I suspect that the Great Planes engineers wanted to keep the process on the conservative side (a good idea!). I repeated this same test, time and time again on 1-, 2-, 3- and 4-cell Li-poly packs from 300 to 2000mAh.

Highlights

- **Handles up to four, 1- to 4-cell, 300 to 3000mAh packs**
- **Auto-selects the correct cell count for each pack**
- **Visual and audible warnings**
- **Each output has a 3-hour cutoff**
- **Continuous cooling fan**

The PolyCharge 4 is capable of charging 1 to 4 Li-poly packs at the same time. Each output can be started and stopped independently of the others.

SAFEGUARDS

The LED may glow orange to alert you of possible errors—from connecting the battery in reverse to system errors or to input voltage that's too high. This is all clearly outlined in the very detailed manual, which is also available online at ElectriFly.com.

As an added safety feature, each of the four outputs has a 3-hour timeout. If one output remains on for 3 hours, that output will automatically cut off. A cooling fan runs continuously from the time input power is applied.

Just to set the record straight, the PolyCharge 4 is only a charger; it does not have any discharge capabilities. Of course, every time you fly, your battery is being discharged, so this really isn't a limitation. Also, keep in mind that the PolyCharge 4 is intended to charge only Li-poly batteries, not any other type of lithium battery and certainly not Ni-Cd or NiMH cells.

Use common sense when charging larger-capacity battery packs that are close to 3000mAh. If you attach four, 4-cell 3000mAh battery packs, the charger may not achieve the full charge current.

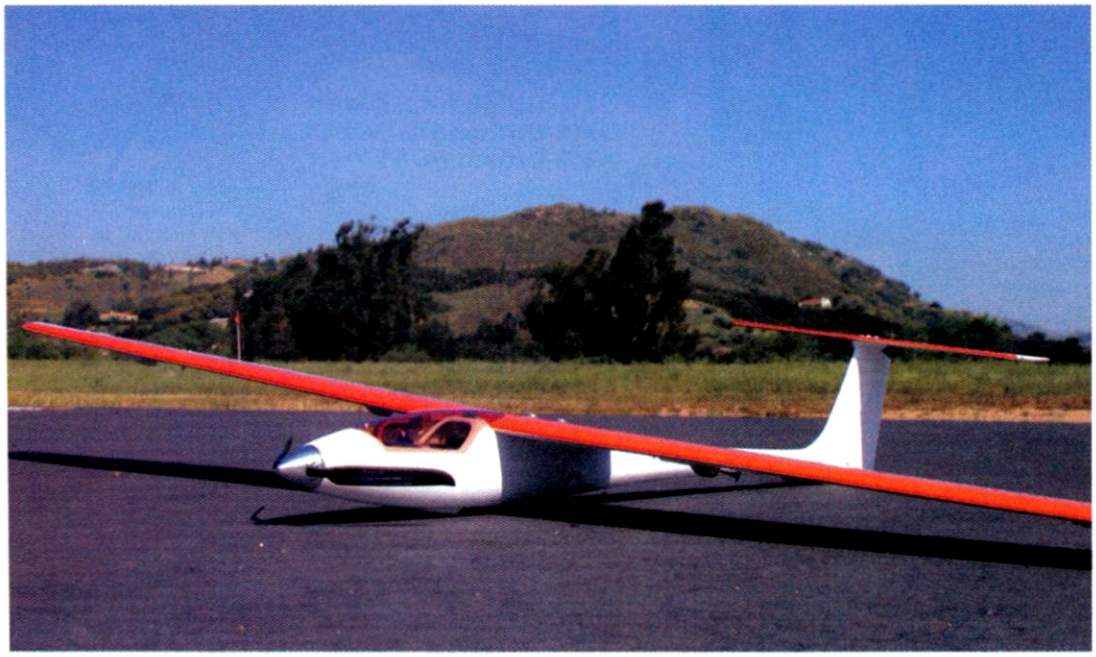
THE VERDICT

The ElectriFly PolyCharge 4 performed exactly as claimed. I found it accurate and repeatable time and time again. I even tried to fake out the cell count, and it still came through with flying colors. I give it an excellent rating, and it's worth your consideration. It could literally keep you flying all day long!

See the Source Guide on page 151 for manufacturers' contact information.

[FlightTest]

BY ORAN BLOODSWORTH || PHOTOS BY JOHN REID



CERMARK BREEZE II

A refined version of a proven favorite

I've built and flown dozens of high-performance sailplanes during the past 10 years, and when I was asked to review the new Cermark Breeze II ARF—an all-around improved version of the popular Cermark Breeze—I was thrilled. In the fast-growing world of high-performance sailplanes, the Breeze II offers great value for the money. It is a complete, full-house electric sailplane with exceptional detail, and it really impressed me.

"The details are impressive, and the construction QUALITY IS EXCELLENT ... **"**

SPECIFICATIONS

MODEL: Breeze II EP ARF

MANUFACTURER: Cermark

TYPE: high-performance electric sailplane

LENGTH: 44.3 in.

WINGSPAN: 78.5 in.

WING AREA: 518 sq. in.

WEIGHT: 52.8 oz.

WING LOADING: 16.5 oz./sq. ft.

MOTOR REQ'D: 500- to 600-size brushed or brushless

RADIO REQ'D: 5- or 6-channel radio w/4 mini-servos and 2 standard servos (6-channel computer radio recommended)

PRICE: $179.95

HIGHLIGHTS

- High-quality wood-over-foam wing/stab construction and an immaculate fiberglass fuselage
- One-night assembly
- Outstanding attention to design detail
- Broad flight envelope

GEAR

RADIO: JR 9303; 4 Hitec 85MG servos (ailerons, flaps), 2 Hitec 525 servos (elevator, rudder)

MOTOR: Cermark 600BL-3

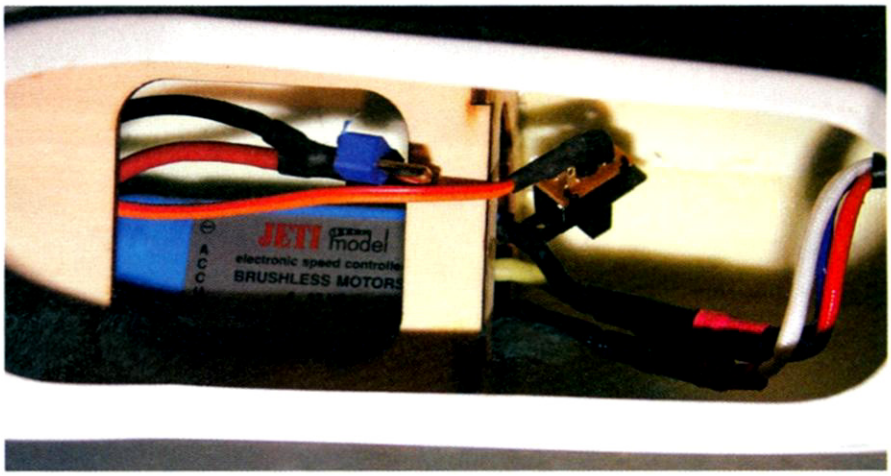
SPEED CONTROLLER: Jeti 70 amp

BATTERY: 10-cell CP1700

PROP: Graupner CAM 12x6 using the supplied Cermark spinner

COMMENTS

This impressive sailplane is a great value; I only wish that the flaps had upward deflection so they offered the option of mixed full-length ailerons and a higher roll rate.



There is plenty of room in the fuselage for any speed control you wish to use; mine was a 70A Jeti.

THE KIT

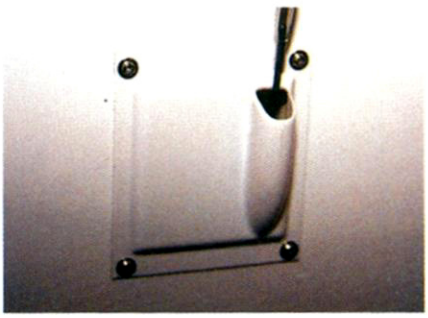
Assembly is quick and straightforward. The kit includes a gelcoated fiberglass fuselage, full-spar balsa-sheeted foam wings, a balsa elevator and rudder, a tinted plastic canopy and beautifully machined aluminum parts. All of the components were individually bagged and neatly packaged. The detailed instruction manual is very easy to understand, and the level of prefabrication is superb. Items such as the machined-aluminum hold-down bushings, aluminum firewall and matching spinner, installed pushrods with attached clevises, installed hardwood battery and servo trays and the routed servo bays and wire channels all add up to a really well-engineered design and an easy assembly.

The wing The wing is constructed of balsa over foam with sandwiched hardwood reinforcements in the servo bays and a full-length spar that incorporates the carbon wing-joiner and joiner tubes. The wing is immaculately covered in UltraCote that also forms the hinges throughout. The wing is secured to the fuselage with nylon wing bolts that sit nicely in machined-aluminum bushings that help to distribute flight loads. The wing roots have hardwood alignment tabs that add a further level of hold-down security.

Once I was satisfied that the wing was securely attached, I unscrewed it and followed the instructions for installing the aileron and flap servos. Both of the wing's wire channels have already been routed, and this made it easy to install the servos and the extended wiring. The kit also includes molded-plastic servo-hatch covers to keep debris out of the servo bays. After only 35 minutes of assembly time, I was attaching the supplied control rods to the clevises, measuring for proper control throw and moving on to the final assembly of the fuselage and tail.

Tail assembly The molded fuselage comes ready to accept the horizontal stabilizer, which requires only two hold-down bolts, both of which are supplied. Like the wing, the horizontal stabilizer has machined-aluminum bushings to spread the load. Attach the rudder using the supplied CA hinges. The pushrods and clevises for the elevator and rudder were installed and required only minor adjustments to fit the control horns.

Another nice touch of Cermark's is its use of machined-aluminum bushings on the wings and tail surface.



The included servo covers fit great. They protect the servo linkage and add a crisp, clean line.

In the Air

The Breeze II is very docile and predictable, and it required only a few clicks of up-elevator to keep it true and level. Its speed range is one of its highlights, and the Cermark 600BL-3 brushless motor provided very brisk, 70-degree climbouts. Loops, rolls and inverted flight were all exceptional; they were controlled and predictable. High-speed climbing and diving provided all the excitement needed to make everyone stop to see what was whistling by. Unlike the original Breeze, the Breeze II seems to have a very strong wing, and that gives its pilot the confidence to fly aggressive maneuvers.

CONTROL THROWS:

- **ELEVATOR** ±5/16 in. (low & high)
- **RUDDER** ±1¼ in. (low & high)
- **AILERONS** ±½ in. (low & high)
- **FLAPS** 1 in. down

GENERAL FLIGHT CHARACTERISTICS

- **STABILITY:** outstanding stability at all speeds tops the Breeze II's highlights. It was also solid through a variety of flight modes, including crow-braking for landing approaches.
- **TRACKING:** aim the Breeze II in nearly any direction and at any attitude, and it tracks true and requires very little corrective input (another trait that makes my "highlights" list). Frankly, it flies as if it were a much bigger sailplane; it tracks so well that it may give you a false sense of your ability.
- **AEROBATICS:** the aileron, rudder and elevator-control surfaces provide ample authority to readily manage nearly any maneuver with precise response. Loops, rolls, inverted flight and high-speed climbs and dives were all flown confidently and under control.
- **GLIDE PERFORMANCE:** glide performance for most 2M high-performance sailplanes is adequate, given their slightly higher wing loadings. The Breeze II really surprised me in this category, as it soared far better than I had expected and even managed to find lift in a few remote thermals.
- **STALLS:** power-on and power-off, stalls are predictable with a modest drop of a wingtip—no bad tendencies at all; the nose just drops, and speed and control are regained.

PILOT DEBRIEFING

Because the Breeze II has full-house control surfaces, I highly recommend a computer radio to take full advantage of the flight-mode mixing. Its wide speed range, gentle stall characteristics and high glide ratio beg for crow-mixed approaches and allow spot landings with just a bit of practice. While at altitude, feel free to push the Breeze II through its paces, as the generous control surfaces provide crisp responses that quickly build pilot confidence.

The Breeze II can be powered in a variety of ways, but I recommend a brushless setup for more spirited and efficient climbs. The 600BL-3 motor is certainly adequate for most pilots, but this plane is very capable of handling significantly more power.

The only other thing I'd like is for the flaps to have upward deflection for full-length aileron mix and a higher roll rate.

Fuselage I installed the elevator and rudder servos in the preinstalled plywood servo tray and connected the servo arms to the control rods. Both ends of the control rod use clevises, so final adjustments are quick and simple to make. The battery tray accepts a 10-cell, sub-C battery pack or a comparable lithium pack and is secured with hook and loop tape.

Final assembly I attached a Cermark 600BL-3 motor to the installed aluminum mount, which is a perfect match for it. I used a Jeti 70A ESC and neatly secured its wiring to the battery tray with simple wire ties. Based on some early bench-testing, I selected a 12x6 prop that provides a good balance of motor duration and performance. The supplied Cermark aluminum spinner really finishes the model off nicely.

With the motor, prop, spinner and battery installed, I checked the CG and moved the battery pack back slightly to place my CG in the center of the recommended range.

Validating the manufacturer's specifications, the finished flying weight of my Breeze II is 3.25 pounds. This includes the Cermark 600BL-3, a 10-cell, 1700mAh pack and a Graupner CAM 12x6 prop. This combo produces 368 watts, or roughly 113 watts per pound—certainly not enough for unlimited vertical performance but more than adequate for sport flying. This thrust-to-weight ratio is still excellent for the model's wing area and gives a very reasonable 16.5 ounces per square foot wing loading.

FINAL THOUGHTS

The Breeze II is a very versatile plane with an outstanding flight envelope, and it's a perfect example of what makes high-performance sailplanes so popular. The details are impressive; the construction quality is excellent; the assembly goes quickly and is trouble-free, and its flight characteristics are on a par with more expensive, high-performance planes. ✦

See the Source Guide on page 151 for manufacturers' contact information.


FUN
EX-TREME 330
EX-TREME 330

FLY!

JOIN THE EXCITEMENT WITH ARF AEROBATS!

For almost forever, RC model clubs have cooked up all sorts of ideas to keep their members interested in attending flying-field events. These outings bring the members and their families together and promote the growth of the hobby—and the club—while offering some weekend summertime fun! Thus, the fun-fly was born. In the beginning, these impromptu events were friendly off-the-cuff endeavors that required pilots to execute simple flight tasks between trips to the BBQ and picnic tables. Timed flights, touch-and-go challenges and even non-flying, taxiing events around balloon pylon courses were the norm. These early events gave tired old trainers and worn-out sport models a new lease on life, since they were considered more or less expendable. Competition, however, soon changed all of that ....

BY GERRY YARRISH || PHOTOS BY GERRY YARRISH, JOHN REID & DERON NEBLETT

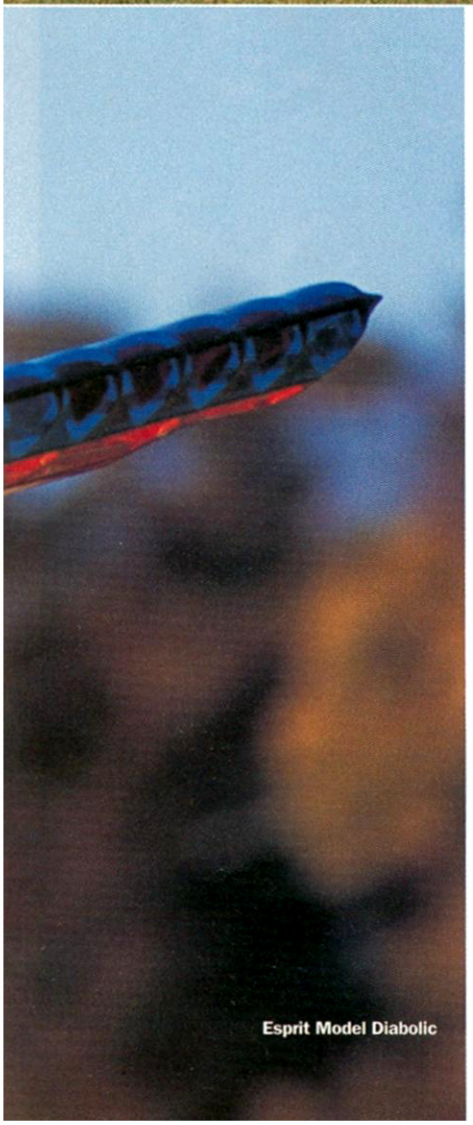
Above: Great Planes U-Can-Do .46. Far left: Carl Goldberg Products Ex-Treme 330 profile. Left: fun-fly contests are a great way to bring club members and their families together. They help the hobby grow.

As pilots became more interested in improving their scores, their models evolved to give them an edge. Soon, fun-fly-specific models dominated the day! Performance went through the roof, and various levels of competition, typically Sportsman and Expert classes, had to be created to keep newcomers interested in all the action. Manufacturers noticed all the excitement, and now, being successful in fun-fly events has never been easier. There are more fun-fly ARF models than ever before, and they make great noncompetitive sport flyers, too. Whether you want to bring home the gold or you just want to improve your 3D flight skills, fun-fly ARFs are the way to go. Let's see what all the excitement is about!

Fun-fly events bring a variety of airplanes together! It's fun to just watch and learn what works—and what doesn't.

Model Tech Magic .46

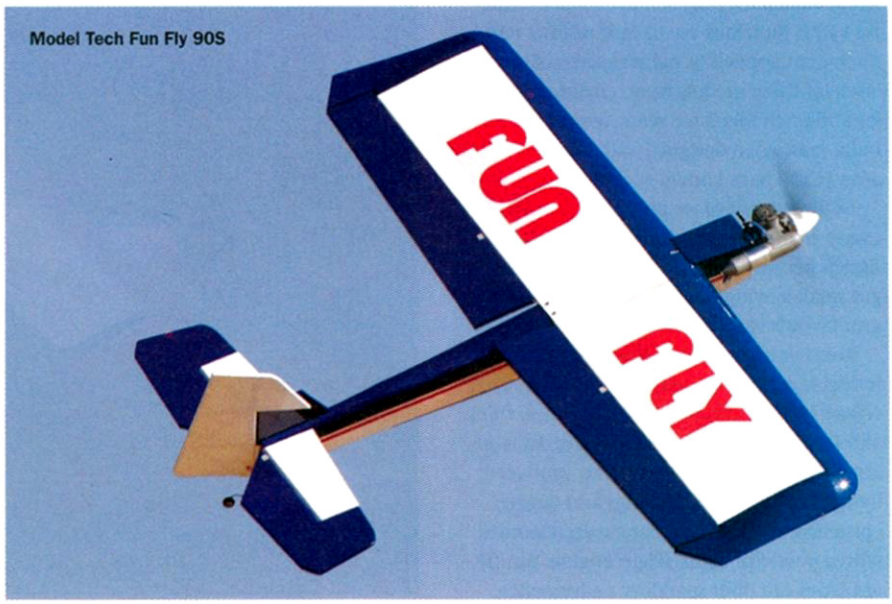
The happy winners at a fun-fly event in Kingston, Ontario, Canada. Having fun and learning to do better makes everyone a winner!



Esprit Model Diabolic

WHERE TO START?

Several types of models fall into the fun-fly category. They range from standard-type models with full fuselage and landing-gear design to lightweight profile models with solid or built-up slab fuselages and built-up wings to the superlight and highly specialized competition fun-fly machines that feature lightweight construction, carbon-fiber tail booms and mono landing gear. It is best to start in the Sportsman class with a model you are very comfortable with and that you can fly in all sorts of weather. That takes practice. Fly as much as you can, and shoot lots of touch-and-go's. With most contests, you have to end tasks on the ground with the engine still running to earn the maximum points. A tail-dragger design is preferable over tricycle gear models, as they are more rugged and weigh less. As your skills increase, your model's performance can be improved as well. And there are a lot of great models to choose from.



Model Tech Fun Fly 90S

Thunder Tiger 3D Spirit

GETTING THE EDGE

What makes a good fun-fly model? To get the most performance out of a model, you need a good power-to-weight ratio, so you can either increase your engine's size, or you can lower the model's overall flying weight! At the higher end of the competition spectrum, it is a little of both. Competitors use the biggest powerhouses they can fit into their models and typically attach a power-increasing, tuned-exhaust system (often homemade); they lighten the model's structure with judicious use of carbon-fiber reinforcement applied to lighter grades of wood. Some of these models have remained popular and unchanged for years, but others are built, crashed, redesigned and rebuilt year after year. That's known as fine-tuning!

In the pursuit of weight reduction, unnecessary elements were eliminated. Model design became simpler: servos and fuel tanks got smaller, wing ribs got fewer, and landing-gear layouts were minimized.

Another important part of a fun-fly model is good slow-speed performance. That comes with weight reduction, but nice, thick airfoils add to the low end of the flight envelope, too. Increased lift and drag, produced by fat wings, help in landings and during cornering and looping maneuvers. Coupled with a powerful, lightweight engine, fun-fly airplanes can offer sparkling performance.

Ah! A little glue, and it will be as good as new!

Hangar 9 Ultra Stick

Gear Check

ENGINES. Any sport engine is adequate to fly fun-fly planes. Personal preference plays a big part in which engines are used; O.S., Thunder Tiger, Webra, Enya and MVVS are all popular choices when it comes to .32 to .50 2-stroke powerplants.

Powerful and reliable engines such as this O.S .46XA will pay for themselves on your journey to the winners' circle.

SERVOS. Precise control is very important, so if you are serious about winning, you have to use good servos. Coreless servos with at least 60 to 75 oz.-in. of torque are a must. They must have good speed, and more important, they should have excellent centering. Digital servos can also offer excellent power and response, but they consume more battery power, so you may have to use a larger battery pack. Most competitors use small microservos for throttle. To avoid vibration damage, use a plastic clevis at each end of the throttle linkage, and lightly tighten the mounting grommets; don't crush them with the mounting screws.

Strong, high-speed coreless servos are essential to good model performance. Centering is also important for consistent control.

BATTERY PACKS. There's no need for big sport packs in the 1000 to 1500mAh sizes. That's just added weight. Switch to smaller cells, and use 350 to 500mAh packs. Fast-charge them before each flight at the field.

RECEIVERS. These, too, should be small and lightweight. Some of the superlight designs use receivers wrapped in foam with their cases removed.

CONTROL LINKAGE. Most 2-56 threaded pushrods are good enough for the job, but be sure to minimize slop. Make sure that the holes in the servo output arms are a snug fit with the clevis or Z-bend pushrod. Always secure the clevises with safety clips, small O-rings, or slices of fuel tubing. For pull-pull rudder and elevator control, you can save weight by using Kevlar thread.

FUEL TANKS. When it comes to carrying fuel, less is always more! Use only as much fuel as you need to compete. Don't fill the tank completely when ¾ tank is all that's needed. Many superlight designs use small, Du-Bro 2-ounce tanks that are simply strapped into place with a few rubber bands.

TIRES. Use tires made of lightweight foam, and make sure that they're as small as the flying field allows. Dave Brown, Du-Bro, Great Planes and several other companies offer them.

Seagull Model Harrier 3D

MORE CONTROL

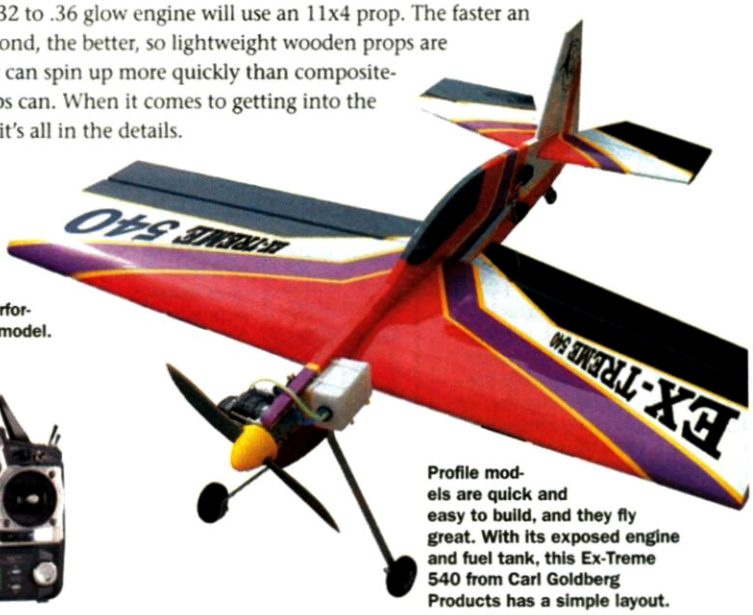
To decrease the time it takes to execute a specific set of maneuvers or tasks, a fun-fly model must be able to climb like a monkey and turn like the devil. To do this, control surfaces have to be bigger, and the servos used to control them have to be fast and strong as well as lightweight. At today's top levels of national competition, models with 42-inch wingspans often have ailerons as wide as 5 inches and elevators that make up 70 percent of the tail surfaces. If not eliminated from the airframe altogether, movable rudders are also becoming enormous!

Lanier RC's Stinger 60—a great starting point.

Managing the control throws also becomes important as their sizes increase, and this is where computer radios come in handy. Getting maximum performance from your servos and control-linkage setups is much easier with the flexibility computer radios offer. Common mixing programs include mixing flaps with elevator for tighter loops; mixing flaps with ailerons for four-surface wing setups to make flaps and ailerons work together; and setting up landing configurations to combine throttle, flaps/spoilers and elevator control for consistent spot landings. Once you start flying fun-fly models, you won't be able to put the computer radio down!

In competition, when a fraction of a second can make all the difference, everything must be optimized. Since the models must have good climb rates while keeping their airspeeds down, they require low-pitch propellers. Depending on the model's design and purpose, a typical .32 to .36 glow engine will use an 11x4 prop. The faster an engine can respond, the better, so lightweight wooden props are favored, as they can spin up more quickly than composite-and-plastic props can. When it comes to getting into the winners' circle, it's all in the details.

Computer radios that allow you to mix functions make a big difference when you want the most performance from your model.



Profile models are quick and easy to build, and they fly great. With its exposed engine and fuel tank, this Ex-Treme 540 from Carl Goldberg Products has a simple layout.

MANEUVERS & EVENTS

So what do you do with a fun-fly airplane? Why, you fly, of course! And you learn to do basic aerobatic maneuvers and tasks as fast as you can! Flying for fun at your local field is a great way to hone your skills, but to truly experience all the excitement, you have to attend a real fun-fly event. There, you compete against others and learn by doing. Here's a tip: go to your first few events thinking, "I want to learn and have fun," and you'll have a great time.

Two types of competitions make up most fun-fly events: timed and task. In timed events, you fly a task or a set of maneuvers while under the clock, and the shortest time wins. Task events include things like bomb-drops or balloon bursts, and your score is determined by how well you do. Events usually start when you start your engine, but some start and stop mid-flight. Usually, there are three or more rounds flown per day with three to five events in each round. An overall winner is determined by tallying the scores from every round.

Being consistent and finishing all your rounds is the best way to improve your score. If you don't finish your rounds, your overall score will suffer. Below: fun-fly competitors have a great time! At the end of the day, friendship and camaraderie are the biggest prizes.

COMMON MANEUVERS

Timed events (lowest times wins)

Touch-and-go's: do as many as you can in the time allotted, or do a certain number and whoever does them the quickest wins.

Dice throw: throw the dice and do that number of loops, rolls, spins, etc.

Roops: take off, do a specified number of loop-and-roll combinations and land.

Limbo: fly under a ribbon a specified number of times.

Deadstick glide: take off and climb for a predetermined amount of time, shut down the engine, and glide back down. Longest flight time wins.

TASK EVENTS

Bomb drop: take off with bomb attached; drop it onto a target. Closest to center wins.

Balloon break: take off and attempt to hit a balloon atop a tall balsa stick within a specific number of passes.

Spot touch-and-go's: Take off and make several touch-and-go's at a target (number of attempts predetermined). The target has three rings, highest points at the center and lower points as you go out. Add up the total points.

Of course, there are many other maneuvers that are combinations of several tasks. The variety of things you can do is the greatest part about fun-fly events. To make the tasks and timed events a bit more demanding, many contests require that your engine still be running at the end of an event. If you snub your prop on the last landing, you get a zero for that event.

To find out more about where and when regional and national fun-fly events are being held, be sure to check the National Competition Fun Fly Association (NCFFA) and RC Universe websites (ncffafunfly.org and rcuniverse.com/forum). They are very informative and contain lots of great product info and event commentary.

The most important thing is to be consistent and finish every event. If you get good scores in one event but then nose over and earn a "did not finish" (DNF) in the next one, you won't finish well. Finishing all your flights, even if not in the top spots, will earn you a better overall standing at the end of the weekend.

So what are you waiting for? Jump into the fun-fly arena and be part of the action! ✦

For bomb-drop competitions, a simple dowel and washer with a streamer attached to it are all that's required—low tech but a lot of fun!

See the Source Guide on page 151 for manufacturers' contact information.

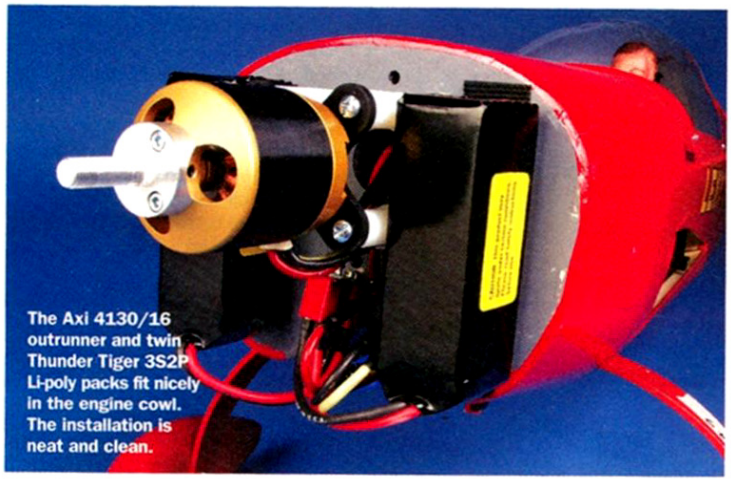
[FlightTest]

BY RICK BELL || PHOTOS BY DERON NEBLETT & PETE HALL

HOBBY LOBBY INTL. EXTRA 300L LEKI

E-powered performer

Electric-powered airplanes have gotten a lot of attention lately, with park flyers taking center stage. I enjoy flying these models, but they can be grounded by less than ideal weather. At electrics events such as the NEAT Fair and SEFF, I noticed that many pilots had converted .40-size and larger glow-powered models to electric power. These models have plenty of duration, and their performance is spectacular. When Hobby Lobby's .60-size Graupner Extra 300L Leki showed up for review with a rather large Axi motor, I was eager to put this combination to the test.



The Axi 4130/16 outrunner and twin Thunder Tiger 3S2P Li-poly packs fit nicely in the engine cowl. The installation is neat and clean.

"Converting the Graupner Extra 300L Leki to clean and quiet electric power WAS UNCOMPLICATED."

SPECIFICATIONS

MODEL: Extra 300L Leki

MANUFACTURER: Graupner

DISTRIBUTOR: Hobby Lobby Intl.

TYPE: sport-scale ARF

WINGSPAN: 63 in.

WING AREA: 657 sq. in.

LENGTH: 49 ¾ in.

WEIGHT: 8 lb.

WING LOADING: 28.07 oz./sq. ft.

MOTOR REQ'D: brushless outrunner; .60 to .90 2-stroke or .90 4-stroke

RADIO REQ'D: 4-channel (aileron, elevator, rudder, throttle)

PRICE: $199

HIGHLIGHTS

- Easily converted to electric power
- Excellent quality kit
- Very aerobatic

GEAR USED

RADIO EQUIPMENT: Hitec Eclipse 7 transmitter, Hitec Electron 6 receiver, 4 Hitec HS-422 and 1 HS-635HB servos (2 aileron, 2 elevator, 1 rudder)

ESC: Jeti Advance Plus 77A Opto & Kool Flight Systems Ultimate BEC

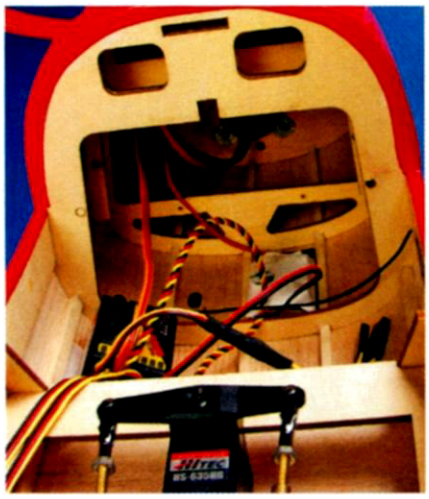
MOTOR: Axi 4130/16 brushless outrunner

BATTERY: Thunder Power 6S2P 4200mAh Li-poly (2, 3S2P, 2100mAh packs connected in series)

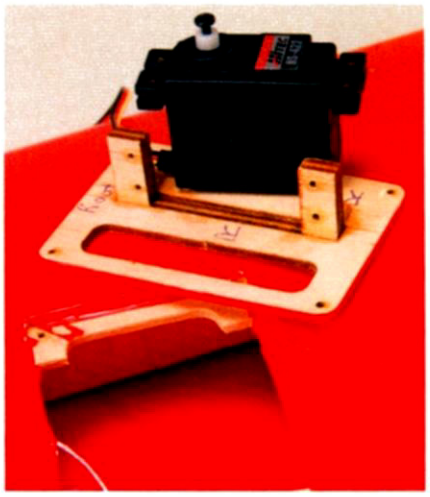
PROP: APC 15x10

COMMENTS

The Leki is a good candidate for conversion to electric power. The components recommended by Hobby Lobby work very well and give the aircraft lively performance.



Only the receiver, the rudder servo and the Ultimate BEC are installed in the fuselage.



The aileron servo mounts come as shown, and the Hitec HS-422 servos are a drop-in fit.

THE KIT

The Graupner Leki is modeled after the famous Extra 300L that was flown by German aerobatic pilot Klaus Lenhart. The Leki is built up of balsa and plywood with a painted fiberglass cowl and wheel pants. All of the main components are built and covered with high-quality heat-shrink film, and the graphics are applied at the factory.

I was impressed by the overall quality and attention to detail. The wing is a 2-piece unit, and there is no need to glue the panels together; they are joined by a hefty aluminum tube and wing bolts. When the wing has been assembled, a removable belly pan hides its center section and is held in place by a tongue and pre-installed spring-loaded pin.

The wing, stabilizer and rudder have full symmetrical airfoils, and all of the flying surfaces are factory hinged and pinned; this really speeds up the assembly process. The rudder is controlled by a pull-pull system that's already routed through the fuselage—a nice touch. The canopy is trimmed and attached to the fuselage, as are a pilot figure and an instrument panel. The included hardware kit is very complete. The instruction manual is in German, and the English translation is very good.

Although the main focus of this review is to electrify the Leki, you can just as easily use a glow engine in the recommended range.

POWER REQUIREMENTS

Before starting assembly, I wanted to know what the airframe weighed. I used a gram scale to weigh each piece and noted that the bare airframe weighed 4.45 pounds—pretty good for a .60-size ARF. I knew that after I had added the motor, batteries, radio system and other miscellaneous items to make the model flight-ready, the Leki would weigh between 7½ and 8 pounds.

Given the model's estimated finished weight, the motor would need to deliver a minimum of 100 watts per pound (800 watts) for good aerobatic performance. The Axi 4130/16 outrunner that Hobby Lobby recommends for the Leki is rated for 60 amps (maximum continuous) and 390rpm per volt (KV) for models that weigh 12 to 16 pounds on 16 to 30 cells.

To power the motor, I used two Thunder Power 3S2P Li-poly packs wired in series to create a 6S2P (22.2V) powerhouse. The 3S2P pack can withstand a 10C average discharge rate and up to 15C in short bursts. Because these packs (3S2P) are two 2100mAh packs wired in parallel, the capacity of the pack is doubled, as is the amount of current that the pack can deliver. This means that the 3S2P pack can be discharged at 42 amps with bursts of up to 63 amps. The 6S2P configuration is for a higher voltage to spin the prop at a high rpm.

I used a Jeti Advance Plus 77A Opto Brushless Controller and a Kool Flight Systems Ultimate BEC (UBEC). A neat feature of the Jeti Plus ESC is its ability to be programmed via a program card. You first set the jumpers on the card for your requirements, connect the ESC's receiver plug to the card, and power up the ESC. In about 1 second, the ESC beeps, and it's ready to go! With the program card, you can program whether you want to use a Ni-Cd, NiMH, or Li-poly battery; motor cutoff voltage; hard or soft cutoff; prop brake on or off; and timing (low for standard brushless motors and high for outrunners).

THE BUILD

The principal tasks to complete are

installing the servos, making the pushrods, figuring out a mounting system for the electric motor and its components and where to install the batteries.

All control surfaces come hinged and pinned. The pull-pull rudder cables have already been installed with all linkages attached. All you have to do is pinch the crimps after you have installed the rudder servo and centered the servo arm.

The only parts that need to be glued together are the tail feathers, and they are self jigging, so it's practically impossible to mess them up. After that's completed, install the servos and control horns, assemble the linkages and hook them up. I completed both wing panels in about 20 minutes. Next, I installed the landing gear, wheel pants and wheels. That completed the airframe, minus the motor installation.

MOTOR INSTALLATION

Instead of buying a motor mount, I decided to make one out of bits and pieces from the hardware store. The motor needs to be approximately 2 inches from the firewall, so I bought eight 1-inch nylon spacers, four 2½-inch 8-32 bolts and four 8-32 blind nuts. Grand total? Just over $6! Combined with the Axi radial mount, the nylon spacers and bolts made a very strong mount.

I offset the motor mount to compensate for the firewall's built-in right thrust and then did a quick check of the center of gravity (CG). To avoid adding any dead weight to the model, the batteries needed to be installed on the face of the firewall on either side of the motor. I also installed the ESC in the muffler tunnel so it would be in the exiting airflow.

I installed the rest of the components (receiver and UBEC) inside the fuselage. I also wired the UBEC in parallel with the battery connector and added an on/off switch as a safety measure. The last item to tackle was mounting the cowl and spinner.

IN CLOSING

Converting the Graupner Extra 300L Leki to clean and quiet electric power was uncomplicated. The Axi motor makes it simple and is a good match for the airframe. As technology has advanced, electric conversions have become a cost-effective choice for high-performance models such as the Graupner Extra 300L. Add to this silent operation and no oily mess to clean up, and you have more reasons to give e-power a try.

See the Source Guide on page 151 for manufacturers' contact information.

In the Air

It is amazing how far electric power has come! After I finished installing the power system, the Extra was ready to go. Two fully charged Thunder Power 3S2P Li-poly batteries, the Axi 4130/16 motor and an APC 15x10 prop combo provided the model with power to spare.

CONTROL THROWS

- **AILERON: ±½ in. (high); ±¼ in. (low); 15% expo**
- **ELEVATOR: ±1 in. (high); ±½ in. (low); 20% expo**
- **RUDDER: ±3 in. (high); ±2 in. (low); 20% expo**

GENERAL FLIGHT CHARACTERISTICS

- **STABILITY: because of its neutral stability, the Extra 300L will stay where you put it until you give the next command.**
- **TRACKING: at ½ throttle, the model was trimmed for hands-off flight. At this setting, the Extra tracked straight and true.**
- **AEROBATICS: like all models of this design, the Extra performs aerobatics with ease.**
- **GLIDE PERFORMANCE: with its moderate wing loading, the Extra glides fast.**
- **STALLS: typical of high-performance aerobatic aircraft, the Extra will tip-stall or snap if too much elevator is used—especially with an aft center of gravity.**

PILOT DEBRIEFING

The power system provides plenty of vertical climb, is strong enough for just about any maneuver and can handle sustained full-throttle when needed. The Leki flies very well, and it does maneuvers the way an Extra should. It won't tolerate a ham-fisted pilot, and you have to be careful with the elevator; if too much is used in a turn, it will really tighten up (but you get plenty of warning). Landings are smooth and very controllable without any bad tendencies. Just remember to keep the speed up to avoid stalls.

If you like to fly IMAC-style maneuvers, the Extra is a wonderful mount, as maneuvers are graceful and smooth. Flip the dual-rates switches, and you have a real tiger on your hands. Snaps are fast but stop quickly, and spins have the same trait. Though not advertised as a 3D model, extreme aerobatics are possible. The model will wing-rock in a harrier, but using spoilerons can mix this out. I could hover the model, but it needs about ¾ throttle with the CG at the forward end of its range; I plan to move the CG aft in the future. I flew for about 10 minutes with plenty of aerobatics, and the batteries were barely warm. When I charged the batteries, about half their capacity was used during these flights.

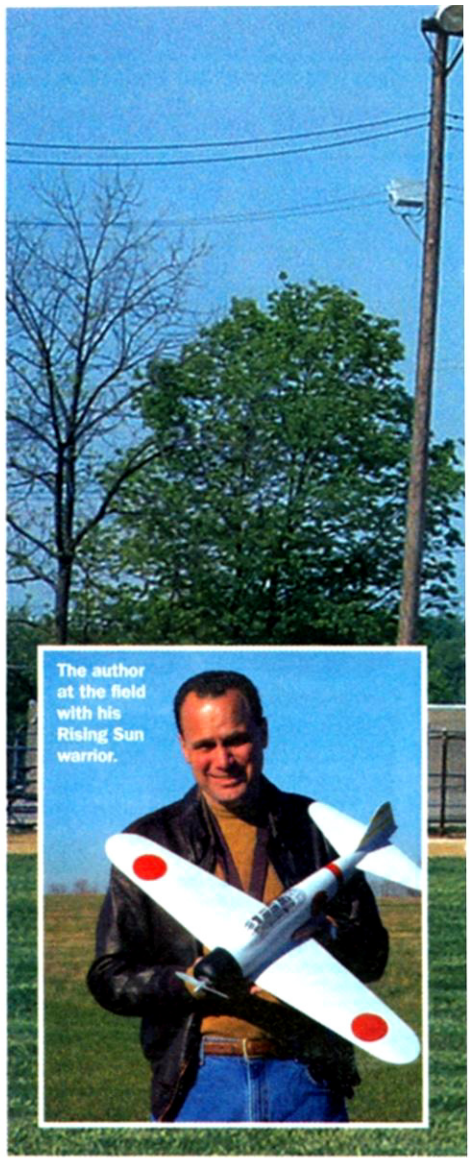
I'm quite impressed by the Graupner Extra 300L and the Axi power system; it's a match that works very well. Because of the model's aerobatic heritage, intermediate to advanced flying skills are needed. All in all, the Leki performs great!

[Construction]

TEXT & PHOTOS BY JIM RYAN

A6M2 ZERO

An electric Rising Sun warrior



The author at the field with his Rising Sun warrior.

Surely, no aircraft epitomized the military power of an entire nation better than Japan's A6M Type-0 Carrier Fighter, better known as the "Zero." The Zero surprised Allied fighter pilots in the opening months of the Pacific war. Most western experts had dismissed Japanese aircraft as second-rate copies of European designs, but the Zero was an entirely original design, and when it entered service in 1940, it was arguably the finest pure fighter aircraft in the world.

The Pacific carrier war has long fascinated me, and I've built models of nearly every U.S. carrier fighter that saw action in the conflict. The time seemed right, then, to design a model of our most notorious opponent. I designed the Zero to the same 1/14 scale as I used for my Grumman Wildcat (see the April 2004 issue of *Model Aviation*), so the two famous adversaries look perfect together.

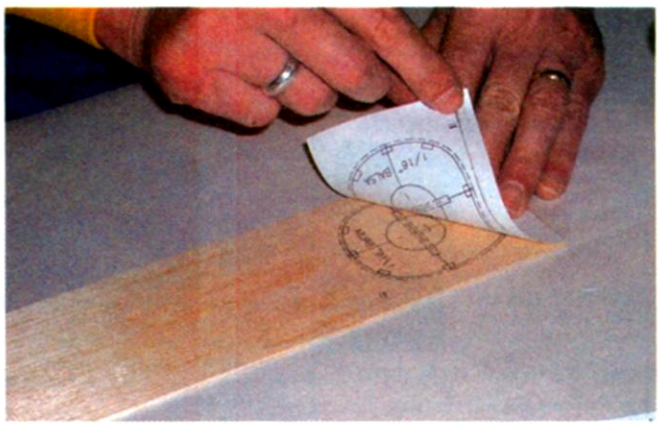
CONSTRUCTION NOTES

The Zero's fuselage is a conventional structure that uses formers, stringers and sheet-balsa construction, and the wing is foam-core sheeted with balsa. The weight goal for the finished, empty airframe is 7 ounces. I use regular thin CA for nearly all construction and odorless CA for the foam wing.

Make a "kit" by cutting all of the major parts to shape first. This speeds the building process. I transfer the part templates to the wood with the acetone transfer method.

Wing After cutting out the wing-cores, sand them lightly and clean them with a workshop vacuum or a tack rag. Install the sub-leading edges with thick, odorless CA; then glue up the wing skins from 1/32-inch balsa,

Begin with a "kit" of precut parts. This speeds assembly considerably.



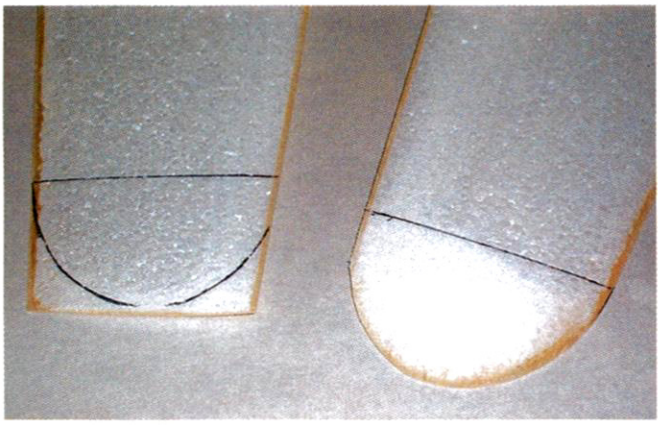
I used acetone to transfer the part templates to the balsa-and-ply sheet stock. This really speeds up the process of cutting out the parts.

"I designed the Zero to the same 1/14 scale as I used for MY GRUMMAN WILDCAT"

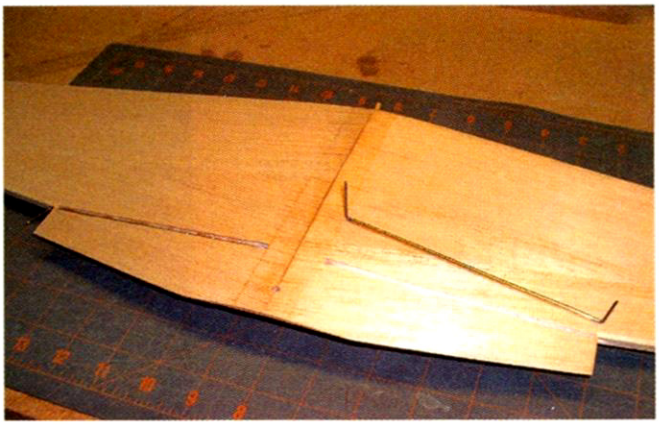
and block-sand them smooth.

To form the rounded, beveled wingtips, you should first sheet the top surface of the panels. I use ProBond urethane adhesive, which foams slightly as it cures. Then trim the leading and trailing edges (LEs and TEs), and cut the wingtip to the radius shown in the wing top view. Draw a guideline on the bottom surface, and use a coarse sanding block to bevel the bottom of the foam wingtip so that it tapers smoothly from the guide line to the top sheeting. Sand the foam smooth with a medium sanding block; then carefully wipe away the dust. When you install the bottom sheeting, pin it down to follow the shape of the wingtip. Run a bead of thin, odorless CA around the tip to firmly bond the top and bottom sheeting together; then trim the bottom sheeting flush with the top sheeting. Last, install and shape the balsa leading-edge cap.

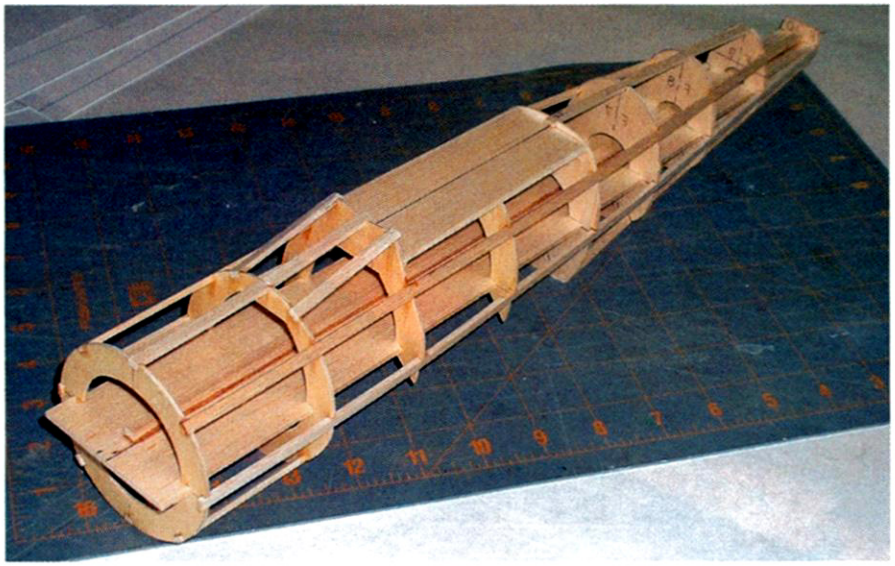
Cut the ailerons from the wing panels as shown on the plans, and cap the exposed TE with 1/8-inch balsa strips. Trim 1/4 inch from the ailerons' LEs, and glue their 1/8-inch balsa LEs into place. Trim the ailerons' length, and cover the ends with 1/32-inch balsa.



I sheeted the tops of the wing-cores with 1/32-inch balsa and then shaped the wingtips before I added the bottom skins.



The aileron torque rods are installed through the bottom of the wing. Be careful not to get glue inside the torque tubes.



The fuselage formers and stringers are assembled over the disposable internal crutch. Even before you add the fuselage skin panels, the assembly is light and strong.

SPECIFICATIONS

MODEL: A6M2 Zero

TYPE: Japanese WW II fighter

LENGTH: 23.5 in.

WINGSPAN: 32 in.

WING AREA: 161 sq. in.

WEIGHT: 18 oz.

WING LOADING: 16.1 oz./sq. ft.

MOTOR REQ'D: Graupner Speed 400 w/Graupner 6x4 prop or Mega 16/15/6 brushless motor w/APC 7x5E prop

RADIO REQ'D: 3-channel (elevator, aileron, throttle)

ESC USED: Castle Creations Sprite 20 (Speed 400), Castle Creations Phoenix 25 (brushless)

SERVOS USED: Hitec HS-55

RECEIVER USED: Berg Microstamp 4-channel

Before joining the wing panels, use a sanding block to bevel the roots to the proper dihedral angle. Each wingtip should be blocked up 1 inch when the panels are joined. Use thick, odorless CA or epoxy; then apply fiberglass reinforcement tape to the joint with thin, odorless CA.

Next, install the 1/16-inch music-wire aileron torque rods. They are fabricated with 3/32-inch brass bearing tubes. Note that the torque rods mate with the ailerons at the very end to form the inboard hinge for the surface. The easiest way to install the torque rods is to cut through the bottom sheeting, remove the underlying foam and then install the torque rods with thick, odorless CA; be careful not to get any glue inside the brass tubes. Next, fill in the slot with 1/8-inch balsa, and block-sand it flush. Cut the hinge slots, and dry-fit the ailerons. I recommend that you install the 1/16-inch-ply aileron servo mount after you've finished the wing.

Fuselage The fuselage is built over a crutch that sets the location for each former. Glue the 3/16-inch-square hard-balsa spine down the center of the crutch to make it stiffer. Make sure that the crutch is absolutely flat and straight. The crutch will be removed after the fuselage is complete. Don't glue the formers to the crutch!

Slide the formers into position over the crutch. Be especially careful to keep F-2 square to the crutch; it determines the thrust line of the motor. Also, do not induce any warping to the structure while adding the stringers. Dry-fit the stringers into place, and after you've made sure that each former is perpendicular to the crutch, glue the stringers to the formers with thin CA. Glue F-11 into place on formers F-4, F-5 and F-6. You should now have a light and straight framework.

Glue the upper edge of the fuselage side panels to the side stringers with thin CA. Note that it's best to install each pair of panels simultaneously so that stresses aren't

Designed by Jim Ryan, this Speed 400-powered A6M2 Zero is 1/14 scale and has a fully sheeted foam wing. The fuselage is built around a removable crutch.

The cowl gun covers are added after the rest of the fuselage has been sheeted. These pieces must be wetted to bend them around the tight radius.

In the Air

The Zero is a very fun model to fly. Whether with a stock Speed 400 motor or with brushless power, it hand-launches with ease, and it's both fast and aerobatic.

CONTROL THROWS:

- **ELEVATOR:** ±3/16 to 1/4 inch, 25% expo
- **AILERON:** 1/8 to 3/16 inch, 25% expo
- **RUDDER:** none

GENERAL FLIGHT CHARACTERISTICS

- **STABILITY:** the Zero is relatively fast for such a small model, but with the Clark Y airfoil and built-in washout, it has no bad habits. The relatively large stab makes it remarkably stable.
- **TRACKING:** the Zero holds a line as well as any of my small warbirds. The way it "grooves" reminds me of my Grumman Bearcat design (*Model Airplane News* plan FSP01991).
- **AEROBATICS:** the Zero is deservedly famous for its aerobatic ability, and this model is no different. With the stock setup, it does all 3-channel aerobatics with ease. The ailerons are very effective, so the roll rate is very quick, and it will do huge loops, Cuban-8s, etc.
- **GLIDE PERFORMANCE:** at the recommended weight, the Zero glides very nicely. I cut power on the downwind leg and then make a gentle turn through base leg and onto final. Landings are very predictable.
- **STALLS:** because of the built-in washout, the Zero is very docile in a stall. Typically, it waffles slightly and then drops the nose. I've been unable to induce a tip-stall. With the clean airframe and low wing loading, stall recovery is very easy.

PILOT DEBRIEFING

The Zero is a remarkably good flyer. All my hand-launches to date have been rock-solid, and it doesn't even need a very hard throw. Once in the air, it's a joy to fly and manages all basic aerobatics with ease. With its comparatively slender fuselage, it's faster than most Speed 400-class warbirds, but it's still easy to land.

I flew the prototype on stock Speed 400 power for the first dozen flights and then changed over to a Mega 16/15/6 on an 8-cell, KAN1050 pack. As usual, I used a Castle Creations Phoenix 25 controller. With the brushless system, the Zero is even faster, but better yet, the greater efficiency improves flight duration. With all power systems, I was careful to keep the CG at 1 3/4 to 2 inches from the leading edge of the wing.

induced into the assembly. Make sure that the side panels overlap exactly half of the side stringers; I find that it helps to make a light pencil mark at each former on the centerline of the side stingers.

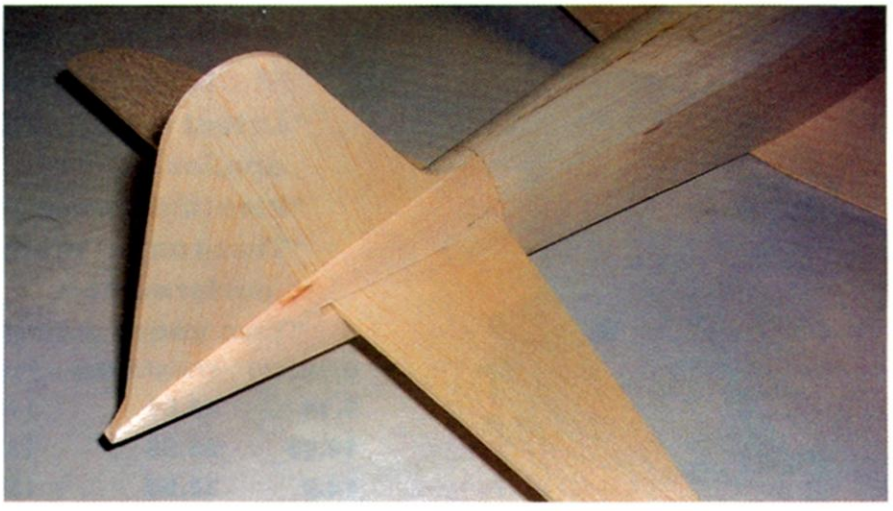
If necessary, dampen the fuselage panels so that they'll bend readily; then carefully push them into place, and glue them with thin CA. Glue the upper panels into place, edge to edge with the fuselage sides. It's best to start at the middle of the panels and work towards the ends. Continue to add the rest of the fuselage panels. The cowl gun panels will have to be wetted to conform to the tight radius; just take your time, and they should fit nicely. Glue the wing saddle doublers to the inside surface of the lower fuselage sides.

By now, the assembly should be very stiff, and you can remove the construction crutch.

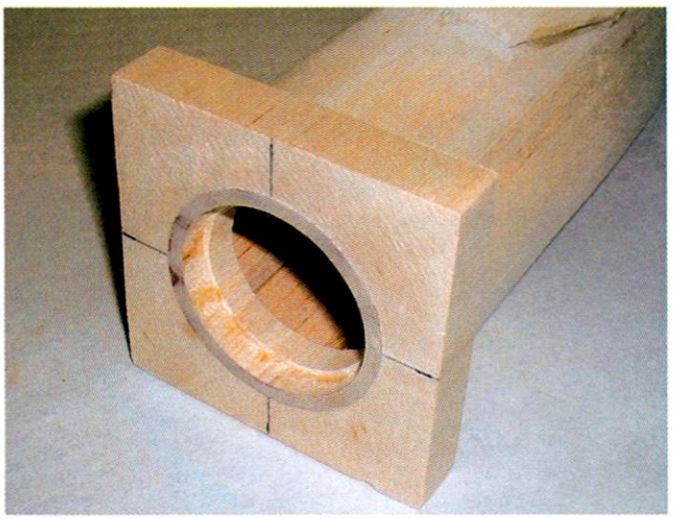
WING INSTALLATION

Block-sand a flat face into the wing root's leading edge so that it will fit against F-3. Trim the trailing edge so that it will fit into the wing saddle. Tap the 1/16-inch-ply wing mount for a 6-32 nylon screw, glue the mount into place and reinforce the joint with 1/4-inch balsa triangle stock. Drill the screw hole through the wing, and install the 6-32 nylon wing screw. Square the wing with the fuselage tail, pin it in the proper position and then drill the wing's LE to accept the 1/8-inch locater dowel.

Empennage Install the wing to the fuselage, and test-fit the stabilizer and vertical fin. Make certain that the stab is parallel to the wing and that the vertical fin is 90 degrees to the wing and aligned with the fuselage centerline. Glue the tail fillet blocks into place; be careful not to glue



The tail blocks have been carved and sanded to shape. The tail surfaces are easiest to install after you've covered the plane.



The cowl block is glued into place and then carved to shape.

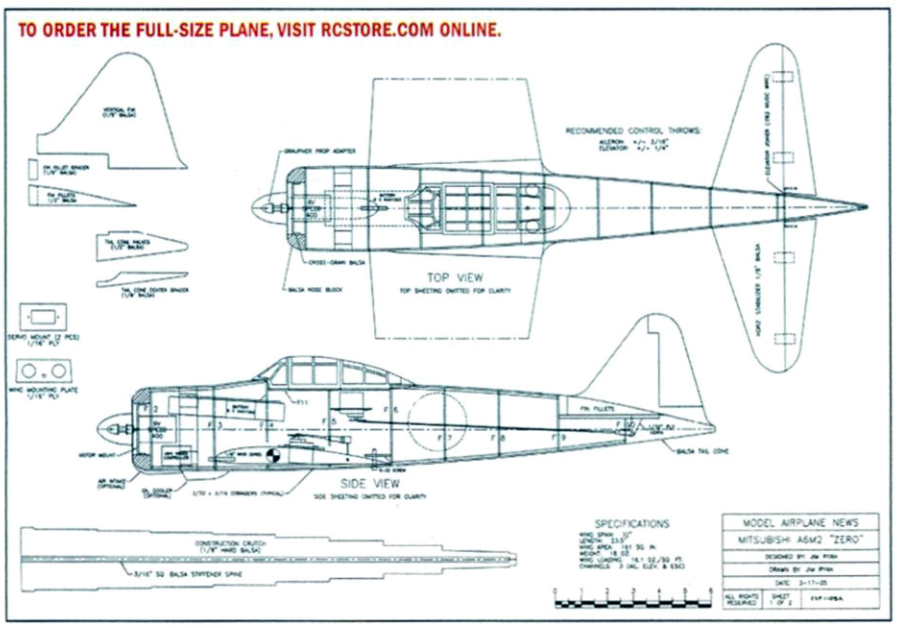
The belly pan is sanded flush with the fuselage sheeting. Be careful not to sand through the sheeting.

them to the stab or the fin. Remove the stab and fin; then carve and sand the tail fillets and tail cone to shape. Cut the elevator hinge slots, and test-fit them. Dry-fit the vertical fin and stabilizer, and test-install a music-wire elevator joiner (you can also use an ⅛-inch dowel joiner if you prefer). I found it easiest to wait until I had covered the plane to permanently install the vertical fin and stabilizer.

Cowl block The cowl is made of a block of end-grain balsa that is carved to shape. Draw datum lines on the front of the block, and use them as a guide for installing F-1, which is really just a sanding guide. Glue the block into place on F-2, then carve and sand it to final shape.

Install the 1/16-inch-ply motor mount after you've covered the model.

Wing fillets The wing fillets are optional, but they really add to the Zero's character. The fillet bases are made of 1/64-inch ply. Install the wing with a sheet of wax paper sandwiched between it and the fuselage. Slip the bases between the fuselage and the wing, and glue them to the fuselage (be careful not to glue the fuselage or the bases to the wing). Make the fillet TEs out of 1/64-inch ply, and trim them to fit. Once the glue has dried, remove the wing and apply light spackle to form the fillets. Let the spackle dry thoroughly (at least overnight), and then sand it to final shape. Finish the fillets with 1.5-ounce fiberglass cloth and finishing epoxy.



Belly pan Assemble the wing on the fuselage; then install the belly-pan formers on the bottom of the wing (be careful not to glue them to the fuselage). Add the belly-pan stringer, remove the wing and install the belly-pan sheeting. Trim and sand the front edge flush with the formers; then reinstall the wing. Sand the joint between the belly pan and the fuselage sheeting flush; don't sand through the sheeting.

FINAL DETAILS

Install the servo mounts with thin CA. Cut the battery-mounting plate out of 1/16-inch balsa, and install it on F-3 and F-4; use ¼-inch triangle stock to reinforce the joints. Apply a strip of Velcro® to the mounting plate to secure the battery pack. I use 0.038-inch music wire for the pushrods to minimize weight.

I covered the prototype with 0.56-ounce glass cloth and painted it with enamel paints. It's a replica of the A6M2 that led the first wave of fighters in the attack on Pearl Harbor. The canopy framing can be painted using the frisket masks shown in the plans. Use masking tape to protect the inside surface of the canopy from overspray. After you've painted the plane, glue the canopy into place with canopy glue such as Pacer Formula 560. Install the hardware, and you're ready to go fly.

NOTE: a parts pack containing the foam-core wings and a vacuum-formed canopy is available from the author for $24 (including shipping). Email Jim at jimryan@fuse.net, or write to him at 6941 Rob Vern Dr., Cincinnati, OH 45239.

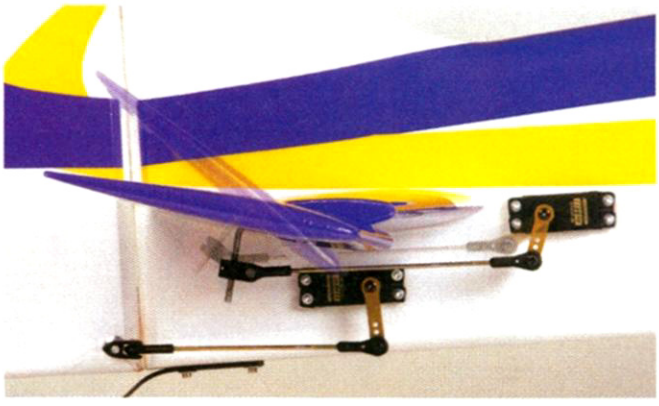
See the Source Guide on page 151 for manufacturers' contact information.

Maximum Control

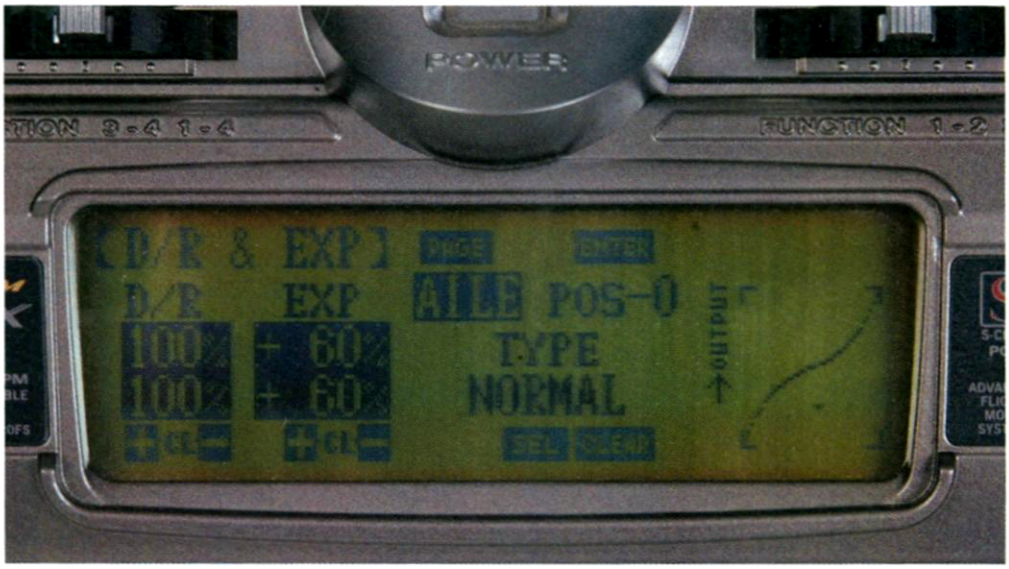
10 EASY RADIO SETUPS

TEXT & PHOTOS BY JOHN REID

Computerized radios have changed the way we control and set up our models. They allow us to fine-tune our planes to suit our flying abilities, and when you open such a radio's manual, you'll read about an abundance of functions. Even entry-level computer radios offer an array of user-selectable programs and mixes. But which computer radio is right for you? We selected our top 10 features; they will enhance every pilot's flying abilities and allow his plane, regardless of its type, to fly better.



1 DUAL RATES. Dual rates allow you to set different control authority for the same amount of stick movement. Computer radio systems offer one to five rates. For example, if your radio offers three rates, you could set the low rate for 50-percent servo travel to fly smoothly at high speeds without too much control authority; the mid rate will give you a little more control authority (about 75-percent servo travel) for landings and aerobatics; and the high rate could be set for 100-percent servo travel for high-alpha maneuvers and extreme 3D aerobatics. This is where you'll need all the deflection you can get from those control surfaces.



2 EXPONENTIAL. Exponential is often used with dual rates, and it gives a softer feel at center stick. This is especially useful when the rates are set high because extreme throws will make the control sticks very sensitive. The slightest movement at center stick will cause the plane to react and to fly a somewhat erratic path. Exponential allows little, if any, servo movement at center stick, but it will increase exponentially until 100 percent of the control-surface movement is reached at full stick travel.

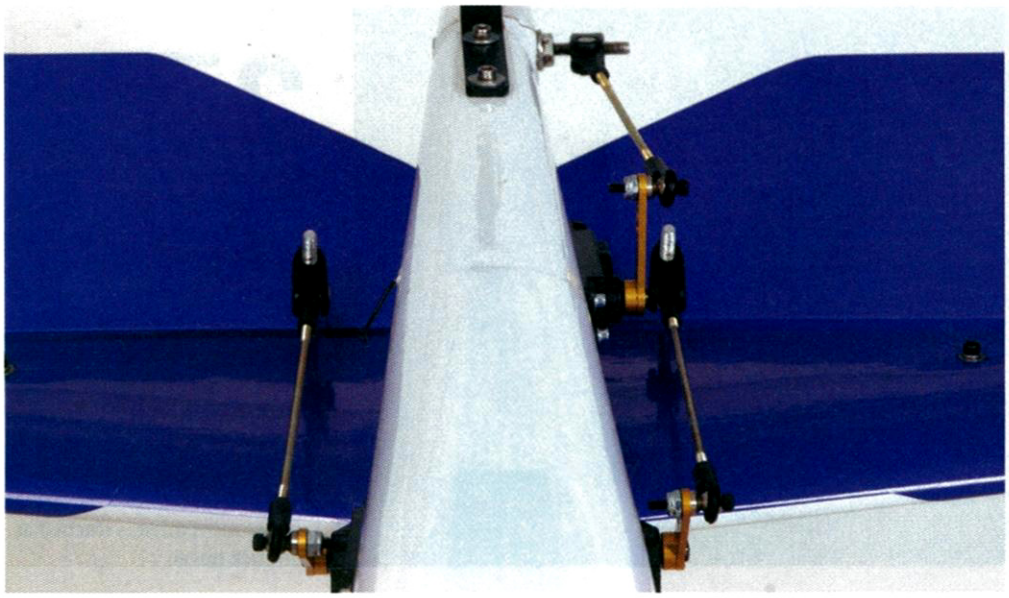
3 TRAVEL ADJUSTMENT. Also referred to as adjustable travel volume (ATV) and endpoint adjust (EPA), this function allows you to adjust a servo's total travel in both directions. You can use this adjustment to set the maximum control throws that you need for flying. Just be careful not to set so much servo travel that it binds by trying to move the control surface beyond its physical limitations. Travel adjustment also allows you to set more throw in one direction than in the other. This is useful when you need more control authority in one direction—for example, having more down-elevator than up-elevator to achieve symmetrical inside and outside loops.

PROGRAM MIXING

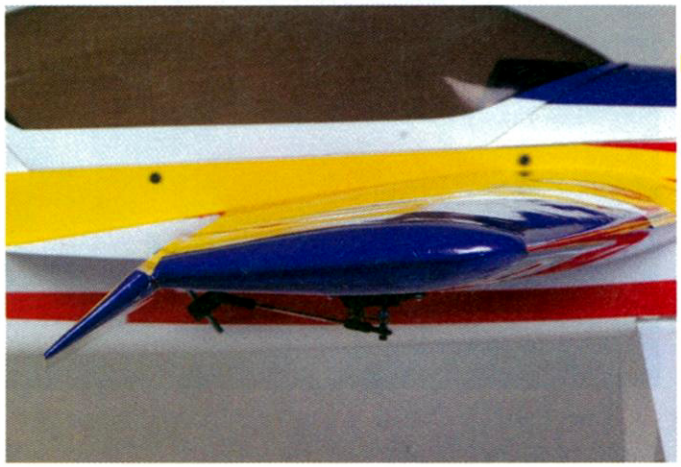
Program mixing can really improve an airplane's performance because it allows you to have one transmitter control movement affect the response of two or more channels on the receiver. Depending on the radio, you can set the mixer up to respond to a control stick, a rotary knob, a sliding lever, or a toggle switch. Mixers are generally used to correct the flight characteristics you don't want and improve the ones you do want. Use them to make your plane fly exactly as you want it to.

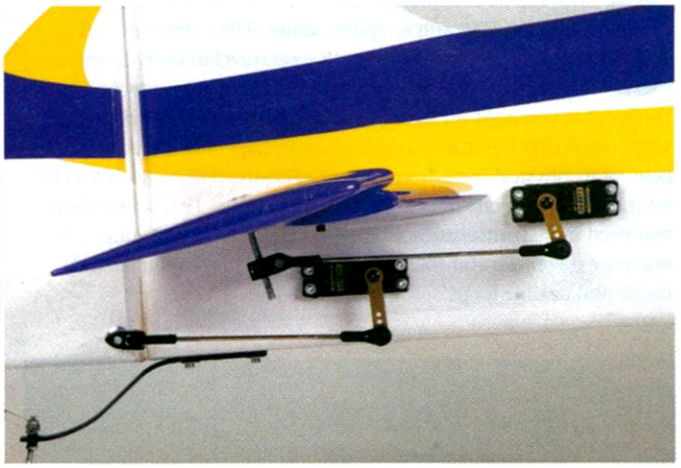
Program mixers work by mixing two or more receiver channels for one control movement on the transmitter. The master channel is the input channel, and the slave channel is the one affected by the mixer. How much slave-channel movement you have can be adjusted and specified by the mixer program. Among the most common mixes are:

4 FLAPERONS. This function is used with separate aileron servos (one in each wing panel) to control both ailerons so that they work together, in opposite directions. The ailerons can be independently adjusted for travel, direction and servo speed. Flaperons can also be used to allow strip ailerons to be used as flaps. Strip ailerons can also be deployed upward to give spoileron control to help with high-alpha maneuvers and at slow speeds for spot landings.



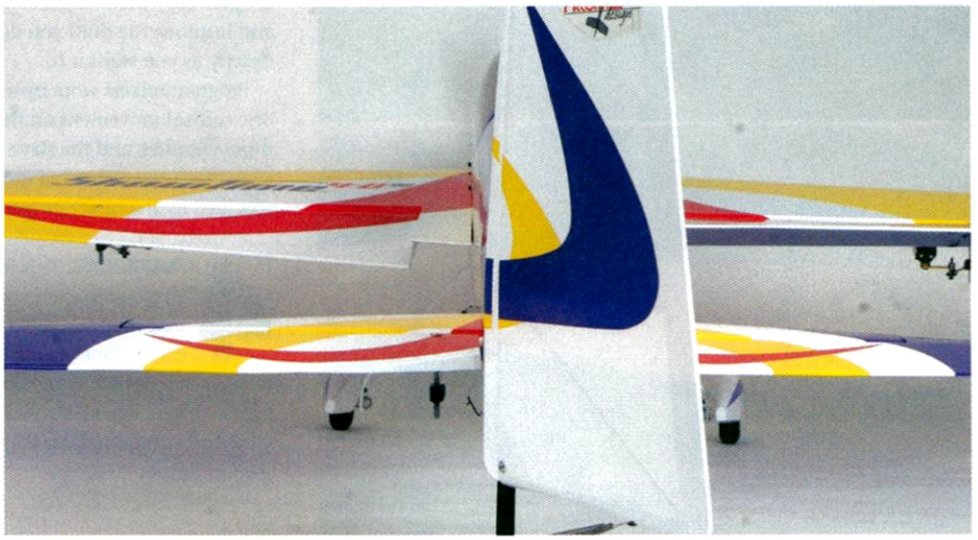
5 DUAL ELEVATORS. Having a servo for each elevator is very important, especially on large-scale aircraft, because a lot of force is imposed on the elevators during flight. Using separate high-torque servos also adds an additional level of safety. Each servo is plugged into its own channel, and the servos work together and share one trim lever. Dual elevator control also allows one of the servos to be reversed if needed to keep all the control linkages and geometry identical.





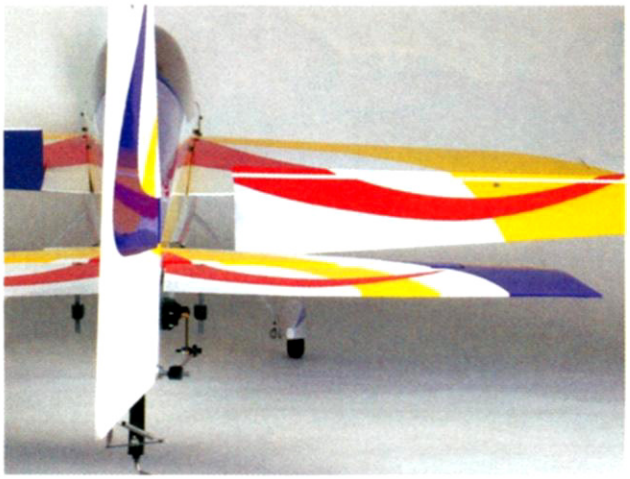
6 ELEVATOR AND FLAP MIXING. Programming the elevator channel as the master and the flap channel as the slave will allow the flaps to deploy when you move the up-elevator stick. Used mostly with fun-fly aircraft, this function allows a plane to fly tighter loops. With scale aircraft, you should have the flap channel as the master and the elevator channel as the slave to provide automatic elevator compensation—upward or downward—when the flaps are deployed (as shown above).

7 RUDDER TO ELEVATOR/AILERON. This mix is used to compensate for unwanted roll or pitch coupling during knife-edge flight. The mixer inputs the appropriate amount of elevator and/or aileron to keep the plane on a nice, straight, knife-edge flight path. This is especially important for aerobatics flown close to the ground. The pilot has to worry only about the rudder stick without dealing with elevator and aileron corrections. Reducing the pilot's workload greatly lessens risk to the aircraft—and the pilot's ego!



8 AILERON DIFFERENTIAL. This is the ratio of up to down movement—the throw—of each aileron. Because the airflow efficiency at the top and the bottom of the wing differs, many airplanes require more upward aileron deflection than downward deflection. By programming in more upward deflection, you can eliminate unwanted yaw when you move the aileron stick.

9 AILERON TO RUDDER. Programming in an aileron-to-rudder mix means that any aileron-stick deflection will also cause the rudder servo to move in the same direction. The percentage of rudder deflection is programmed into the mixer by the pilot. This cooperative movement of the aileron and rudder allows most airplanes to execute scale-like turns, and it prevents adverse yaw with high-wing and scale models.



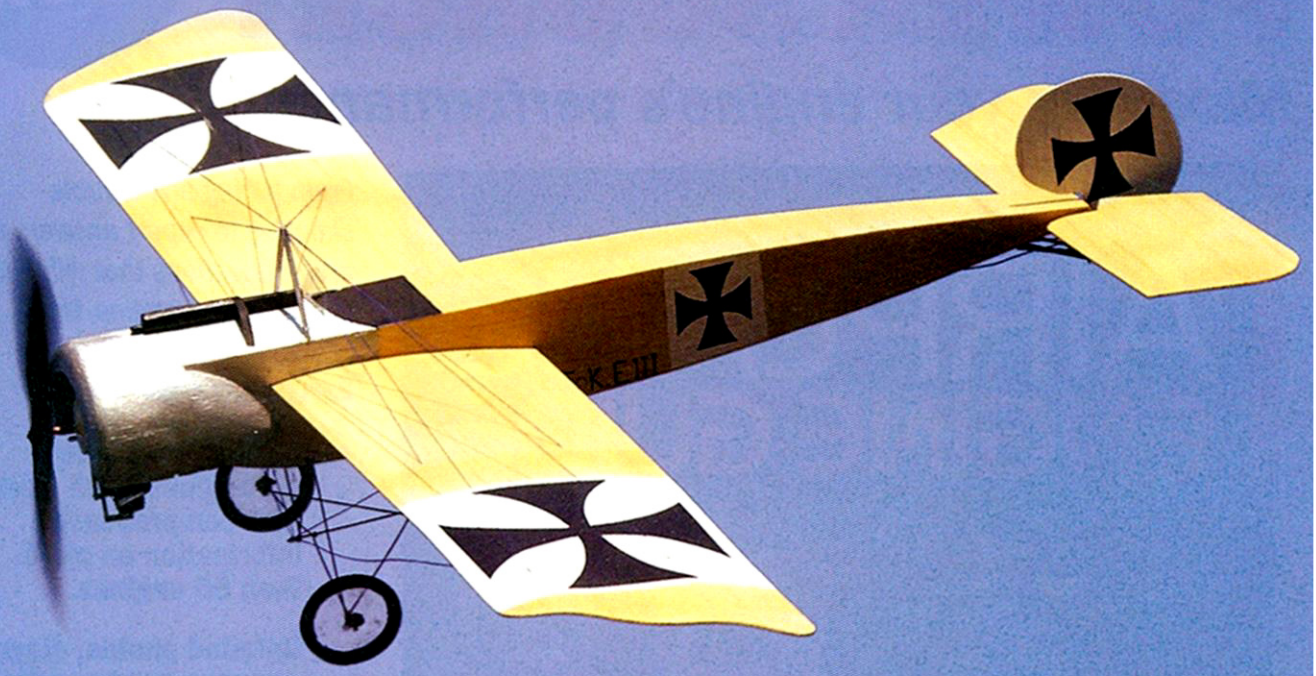
10 FLIGHT MODES. A flight mode is a configuration that's designed to help the pilot and aircraft fly with the optimum settings. Think of flight modes as a one-switch-does-everything function. You can program the flight modes for takeoff, landing, flying at normal speeds, high-speed flying, slow-flight maneuvers, 3D flight and any other flight settings you may need. The idea here is to program each flight mode to provide the ideal aircraft configuration for a particular task. With a flip of a switch, you can have the plane go into landing mode, which could include lowering the flaps, lowering the retractable landing gear, adjusting the elevator and aileron to compensate for the extra drag and moving all the servos to high rates to allow responsive control movements at the slower speed. Having one switch control all these simultaneously reduces the pilot's workload and allows him to concentrate on flying.

Take the time to program in at least some of these functions and try them out; if you don't like how your plane responds, just erase them. But I'm willing to bet that once you try them, you'll like what they do for your flying and will program them in for all of your other models.

See the Source Guide on page 151 for manufacturers' contact information.

[MicroRC]

TEXT & PHOTOS BY DAVE ROBELEN



MICRO FOKKER EINDECKER

Build a little piece of history

Greetings, fellow micro fans! How many of you have had an itch to fly a miniature piece of history? I have long been an admirer and a student of WW I aircraft, but I've hesitated to model one in miniature. I suppose my main excuse was their relative complexity along with their typically deficient stability. Still, as I gained experience with the magnetic controls and construction techniques, I had fewer excuses not to give one a try. The selection of my aircraft was simple; the Fokker Eindecker (German for "monoplane") has a special charm all its own as well as a special place in history.

SPECIFICATIONS

WINGSPAN: 16.4 in.

LENGTH: 12.2 in.

WING AREA: 48 sq. in.

WEIGHT: 1.1 oz.

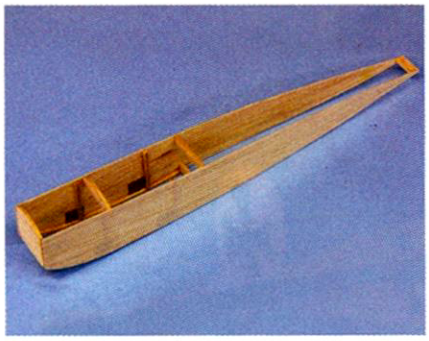
WING LOADING: 1.65 oz./sq. ft.

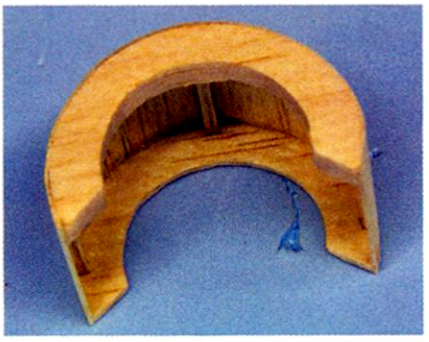
RADIO REQ'D: 3-channel micro-receiver with magnetic actuators

MOTOR REQ'D: Mabuchi M20LV with 6:1 drive

BATTERY: 170mAh Li-poly

COMMENTS: the Micro Fokker Eindecker is a close-to-scale micro model with relatively simple construction. It has gentle flying qualities and can stay within the confines of a baseball infield or basketball court. Because of the detail involved, it is better as a second micro project.





Left: the basic fuselage structure is simple and strong. Right: the cowl is assembled out of balsa rings with 1/32-inch sheet balsa wrapped around the outside.

The Eindecker was the first aircraft to have a forward-firing machine gun that was synchronized with the propeller, and it wreaked havoc on Allied observation planes for quite some time. This is even more amazing when you consider that the Eindecker was fairly unstable and required a pretty talented pilot just to fly it straight and level. This instability is the primary reason for a variety of modest differences between the model's design and that of the full-size aircraft. As presented, the Eindecker model is a smooth flyer with decent stability and a lot of charisma in the air.

LET'S GET STARTED

Though not particularly complex, the model presented here is not a suitable subject for a first micro project, mainly because of the detail involved and the inherent delicacy of some of its parts. Get a bit of building and flying time on a more basic sport model, and then have at it.

The Micro Eindecker is an all-balsa model, and as such, it is vitally important to select light wood for the airframe—especially the parts that go behind the center of gravity (CG). A suitable piece of 3x36x1/32-inch balsa should not weigh more than 6 grams. I can recommend Lone Star Models (lonestar-models.com) as a supplier that ships consistently high-quality balsa. Several other suppliers are equally reputable, but I can personally recommend Lone Star.

The basic airframe is, well ... just that—pretty basic. For a nice, warp-free result, I wet-formed the wing panels to the airfoil shape before I added the ribs. My choice of adhesives was a bit unusual: I used very little CA. I assembled just about all of the balsa/balsa seams and joints using Elmer's Carpenters Wood Glue. The extra drying time really came in handy. Ambroid cement was especially useful for making neat wire/wood joints, and I used medium CA for adding details.

The fuselage is a simple box structure with a few internal braces and crosspieces. Installing the top and bottom planking cross-grain adds some needed stiffness. Don't forget the little plywood patches for the landing-gear installation. The cowl goes together by joining C1 and C2 with three 1/16x1/8-inch strips and then wrapping the 1/32-inch skin around these. Add the 1/16-inch laminations to the front, and sand them to shape.

With the top deck on the fuselage, add the cowl and the soft fairing blocks. I chose to locate my equipment-access hatch between the landing-gear struts, and that has worked out just fine. Cut the tail feathers out, then sand all the parts smooth with 400-grit wet-and-dry sandpaper (I used it dry).

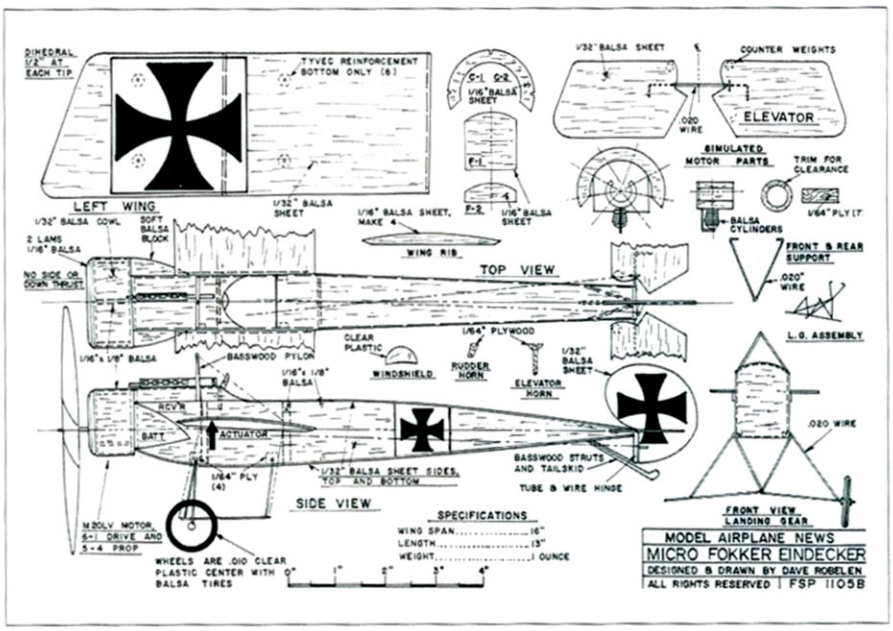
At this point, I chose to paint the airframe's basic parts. For primer, I used Delta Top Coat Satin Spray (available at craft stores). I dusted on two coats, sanding each one with 400-grit paper until smooth. For the colors, I used Dupli-Color—a brand of automobile touch-up spray paint—but any lacquer-based paint would do fine. I sprayed a couple of tablespoons of this paint into a container and then mixed it 50:50 with slow-drying auto-paint thinner. This mix may be applied with very inexpensive airbrushes for a light color finish. I did get lazy and use black trim film for the Maltese crosses; I dulled the film with the Satin Spray before I affixed it.

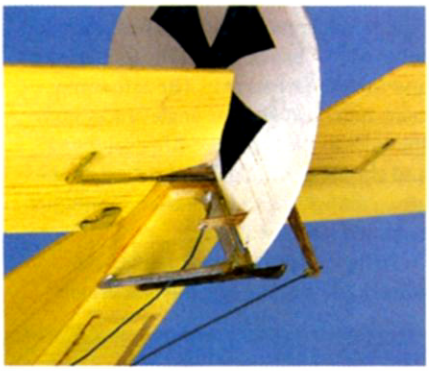
Mounting the wings requires careful measuring to make sure that both sides have the same incidence. Because it dries slowly, wood glue is a big help here. I added the tailskid at this point and then painted it with enamel model paints. To attach the tail's control surfaces, I used sections of a hypodermic needle slip-fit onto 0.020-inch-diameter wire. Note the balance weights on the horizontal tail; they help prevent the actuator from having to fight gravity along with flight loads.

WHEELS UP

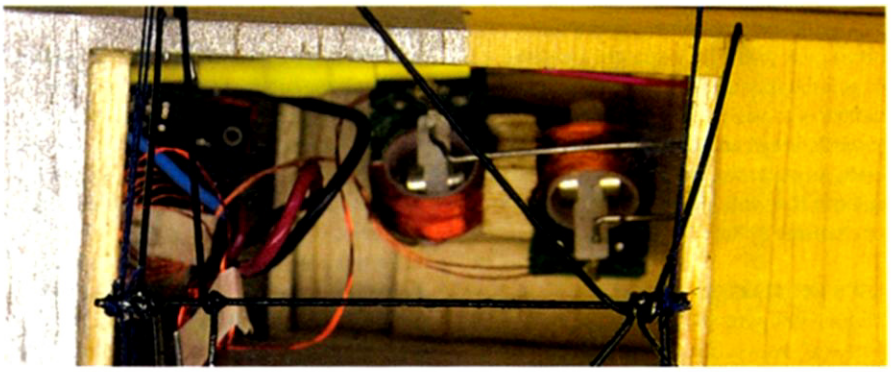
The watchword for the landing gear is "patience." It helped me a lot to assemble the gear upside-down on a hardwood block and tape the pieces into place until it was time to solder them. I started with the two, inverted "V" braces, added the fore/aft shaft and then the wheel axle. The axle struts came next, and last, the angle braces from the axles to the rear apex. After soldering and checking the alignment, I cleaned the gear, painted it with black enamel and then mounted it on the fuselage.

There are several ways to detail the wheels. Most of the original Eindecker's





The tail surfaces pivot in tubing bearings. Note the extra-long elevator horn.



The actuators are mounted close together to give positive centering and smooth control.

spokes were covered to give the wheels a solid appearance. You can replicate that with balsa sheet and white bond paper. Small wire wheels are also available from several dealers, and they would work just fine, too. Being a natural tightwad, I used the method shown with the plastic disc representing the spokes and balsa laminations for tires. The choice is yours.

I have not yet mentioned installing the thread rigging because it would just get in the way at this point. This is, however, a suitable time to install the equipment.

The top cylinders were left off to clear the motor and drive gear.

POWER & CONTROL

My original model had an RFFS-100 receiver, a 170mAh Li-poly battery and two, 1-gram DWE actuators with Hutchison hardware. The drive is a homemade setup that uses 6:1 gears mounted on a 1mm prop shaft that is supported by 1mm ball bearings and a Mabuchi M20LV motor. You can either trim out a wooden 5x4 prop or use a GWS 5x4.7 plastic blade. The control horns are shaped out of 1/64-inch plywood while the control rods are 0.015-inch wire with 0.020-inch copper ends at the actuators.

To achieve proper balance, all of the equipment must be well forward in the fuselage. That caused me some grief with the receiver until I added two, 0.01 microfarad capacitors between the motor brushes and the case. Problem solved! Quarter inch up and down is suitable for the elevator throw, but the rudder should move about 1/2 inch each way. Free movement is essential for smooth control.

The scale engine is a major feature of this machine, and it's worth doing well. The crankcase on mine is made of segments of 1/64-inch plywood glued around a 1/16-inch balsa ring. The seven cylinders are balsa dowels spun in a drill and shaped using a Dremel tool with a cutoff disc attached. After I had attached the cylinders to the case, I checked for clearance around the drive and trimmed as needed. When this was finished, I added a coat of flat black enamel, and that gave it a very realistic look. For valve pushrods and rockers, I used bits of basswood painted silver and glued into place.

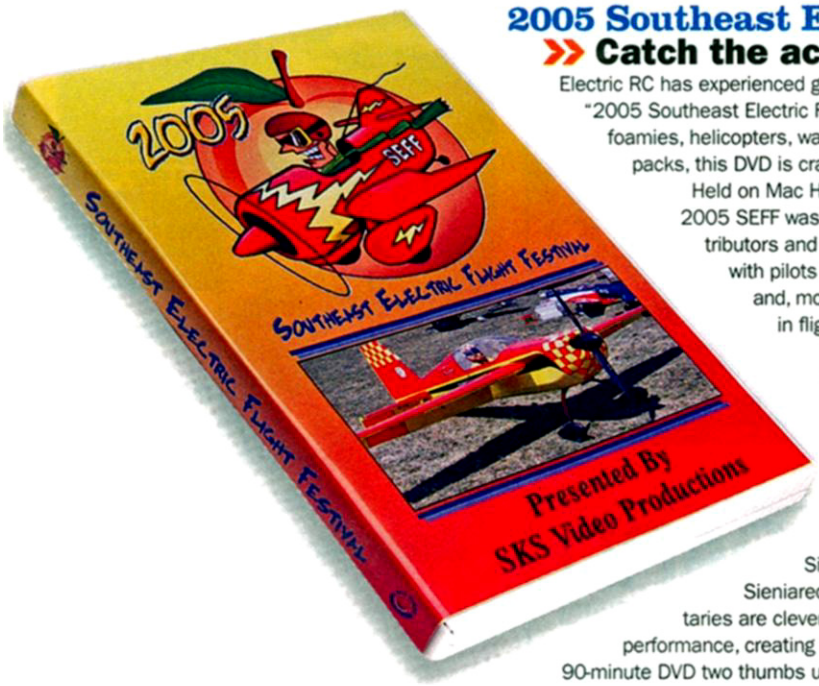
Remember the rigging? Let's do that now. I used smooth, black sewing thread for visibility. Start each strand at the landing-gear attachment point, loop it around the wing, the pylon, the wing and back to the landing gear. Four loops will do the job.

When it comes time for the test flights, you have a couple of choices. If you have calm winds and soft grass, a hand-launch is completely safe. If you're flying indoors, let the model take off from the floor. This little Eindecker is really easy to fly, but getting that initial trim with all that neat detail justifies a little caution. Enjoy!

See the Source Guide on page 151 for manufacturers' contact information.

[ProductWatch]

SKS Video Productions
2005 Southeast Electric Flight Festival DVD
» Catch the action



Electric RC has experienced great advances over the past several years, and SKS Video's "2005 Southeast Electric Flight Festival" (SEFF) DVD documents this RC evolution. From foamies, helicopters, warbirds and giant-scale models to motors, servos and battery packs, this DVD is crammed with something for every modeler.

Held on Mac Hodge's beautiful, 1,700-foot flying field in Atlanta, GA, the 2005 SEFF was quite a sight. SKS Video captures the open fun-fly's top distributors and their cutting-edge technology and also features interviews with pilots and vendors, demonstrations, contests, the awards ceremony and, most important, terrific footage of quite a diverse group of models in flight.

From scratch-built original designs to ready-to-fly kits and the latest and greatest advances in electric RC, this DVD is packed with eye candy for every enthusiast. Although the editing and transitions between the pilot interviews could have been a bit tighter, the excitement of the day is apparent. This DVD features such models as David Ho's RV-6 by Experimental Aircraft Models, Jason Merkle's Hangar 9 Showtime 4-D, Allen Mrock's S39 Sikorsky prototype, David Payne's Graupner Voodoo Chile, Mike Sieniarecki's Hangar 9 F4U Corsair and many more. Pilots' commentaries are cleverly dubbed over detailed shots of their models and their flight performance, creating a documentary that flows smoothly. I enthusiastically give this 90-minute DVD two thumbs up. Cost: $24.95. —*Jill Swiatowicz*

SKS Video Productions (800) 988-6488; sksvideos.com.

Fourmost Products
Miter Sander & angled sanding slides
» Precise angle producer

Designed for modelers who insist on perfection, Fourmost Products' Miter Sander produces perfectly matched angles in balsa and other wood parts. The unit has a hardwood base with a printed angle gauge and a glass-filled nylon miter angle arm to accurately hold the wooden part being sanded. The sanding slide moves effortlessly in the guide groove and comes with removable sandpaper in two grits. Having accurately sanded angles greatly increases the strength of a glue bond in light structures, and the Miter Sander is ideal for making several identical parts. Used with the angle-sanding slides ($7.95), the Miter Sander ($24.95) allows you to sand precise compound angles in 1- to 8-degree increments. If you want precision, these well-made workbench buddies are for you. —*Gerry Yarrish*

Fourmost Products (503) 357 2732; fourmost.com.

Zurich Intl.
Z-2 sunglasses
>> Eye protection with style

Over the years, Zurich sunglasses have been used by countless RC pilots and have contributed to eye protection by filtering out UV light. These high-quality sunglasses make gazing skyward at our planes less of an ordeal when the sun is high. In addition, Zurich sunglasses double as safety glasses because they're impact resistant.

Zurich Intl. now offers new Z-2 model sunglasses that look great and more like regular eyewear (older models fit over regular glasses and were relatively large). The Z-2 glasses have optically ground lenses and block out 98 percent of UV-A, 100 percent of UV-B and 65 percent of infrared radiation. The 180-degree wraparound lens is excellent for peripheral vision; they're scratch-resistant, heat-resistant, lightweight and shatterproof. There aren't any metal hinges or screws to corrode or loosen. Intended for contact-lens wearers, at $69, each Z-2 carries a limited warranty and is available in Light Silver Gradient, Silver Solid, Blue Solid and Teal Solid. *—Gerry Yarrish*

Zurich Intl./Zurich USA (916) 691-6467.

Cermark
CEM-4220-770 Outrunner
>> 3D power for .40 planes

In the world of high-performance aircraft, a long list of power options is available, from high-speed direct-drive to geared, high-torque systems. That list has just been extended to include high-performance outrunners such as the newest line of motors from Cermark. I tested one motor in this series—the CEM-4220-770—in a .40 3D-capable aircraft that weighs approximately 3 pounds. The motor itself weighs 7 ounces and can operate in the 600W range. It's 2 inches long and 1.67 inches in diameter.

Outrunners differ from standard motors because the magnets are in the bell and are not centrally located; this allows the motor to encase more magnets and thus increase the torque it can produce. Another advantage is that the magnets are glued into the bell rather than to the main shaft, so as motor rpm increase, the centrifugal force increases and holds the magnets more tightly in position. The only downside is efficiency: because of their configuration, outrunners tend to use more power than standard motors, but once you add gearbox and bearing drag, the overall efficiency is comparable.

Operating at 54 amps, the CEM-4220-770 was a perfect match for my 3D test bed. I also used a Duralite Gold 5000mAh, 11.1V Li-poly pack, a Castle Creations Phoenix 80 speed control and an APC 16x8 electric prop. On takeoff, I immediately felt the smooth, quiet power this motor has to offer. After a loop or two around the field, I flared the test plane up just a little then into a hover. I checked my radio input and was amazed to find that it was at just under ½ throttle. As I powered up a bit, I felt a blast of air from the propeller as the plane flew vertically at an incredible speed. After I had landed it, I checked the motor temp; it was barely warm to the touch at 94 degrees. This powerhouse costs $105.

Need to see it to believe it? Check out the video at highdesert3d.com/extras/cermarkmotortest.wmv. *—Dave Harris*

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ARTICLE & PHOTOS BY GERRY YARRISH

The Awesome INDEPENDENCE!

Carl Bachhuber of Mayville, WI, has a mission—to design, develop, build and fly every airplane he has ever liked! Now, that's a tall order for any modeler. In his 50-plus years of modeling, Carl has redefined the term "giant scale." He has scratch-built a 170-inch Avro Lancaster, a 180-inch Boeing Stratocruiser, a 165-inch B-24 Liberator and a 182-inch B-32 Dominator, just to name a few! All are powered by multiple Zenoah G-23 or G-26 engines, and each is a beautiful scale masterpiece.

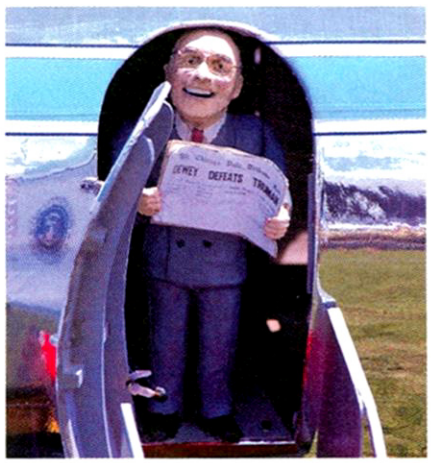
Carl's newest project is a Douglas DC-6 (VC-118) that carries the paint scheme of President Harry S. Truman's official transport aircraft, the "Independence." (The VC-118 was the military version of the Douglas DC-6 commercial airliner.) In 1947, the U.S. Army Air Force ordered the 29th production DC-6 and had it modified to be the replacement airplane for the aging VC-54C "Sacred Cow" presidential aircraft. In May 1953, after nearly six years of White House service, the "Independence" ended its presidential service and was commissioned to fly as a U.S. Air Force VIP transport. In 1965, the aircraft was retired for display at the USAF Museum at Wright-Patterson AFB in Dayton, OH.

Carl's model was finished early in 2005 and first flew in April. Carl says the test flight was uneventful, and the massive airplane lifted off easily in about 150 feet. It required a little trimming, and on the second trip around the pattern, the right inboard engine died. Nevertheless, the plane handled well and landed easily on its three remaining engines.

The massive airplane lifted off easily in about 150 feet.

The DC-6 is 13-percent scale and has a span of 180 inches. It weighs about 95 pounds and uses four Zenoah G-26 gas engines for power. As do all of Carl's giant models, the DC-6 uses traditional balsa and plywood construction and has scratch-built retracts equipped with Robart brakes.

Carl says, "I hope to be able to continue scratch-building for a while longer. I do enjoy flying these rather large and unusual planes at fly-ins and shows all over the Midwest." We hope so, too, as his building talents are inspirational. Mission accomplished, Carl!



How's this for added detail? After the "Independence" lands, a ladder truck pulls up, the door opens, and a miniature President Truman exits holding the *Chicago Daily Tribune*'s famous edition headlined "Dewey Defeats Truman"!